JANUARY 1958—SIXTY FOURTH YEAR

Machinery

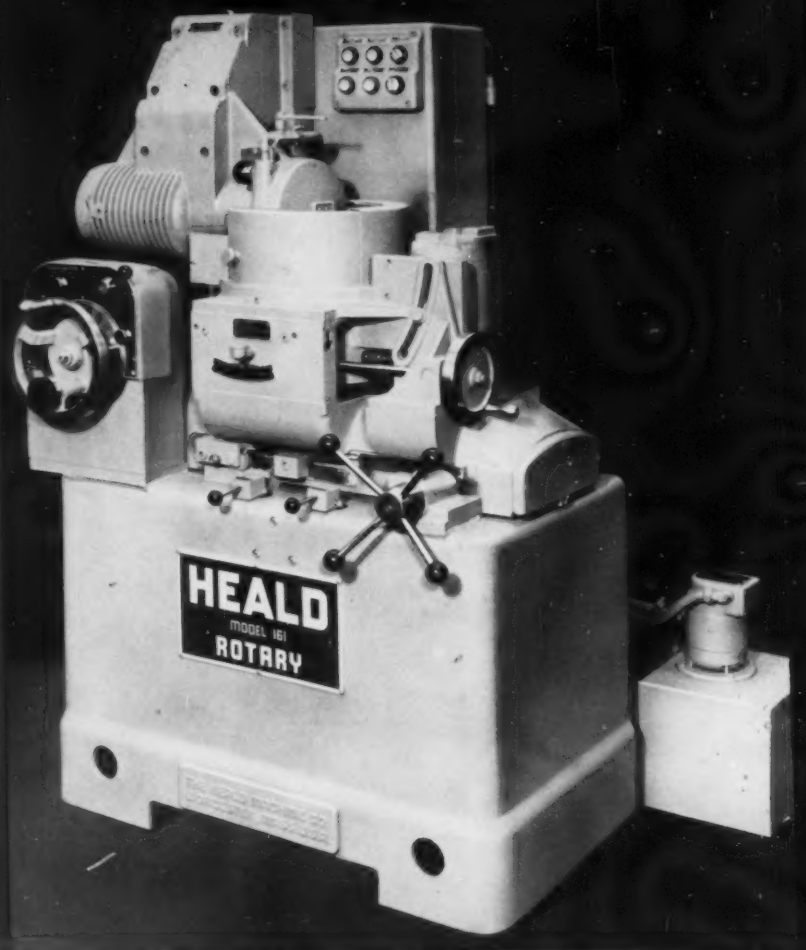
For turning, boring, threading, cutting-off and most other lathe operations, use the world's leading tool holders — ARMSTRONG. They reduce tooling cost. *Carried in stock by leading Industrial Distributors.*

ARMSTRONG
TOOL HOLDERS

No. T-2-L ARMSTRONG TOOL HOLDER, with Armide Carbide Tipped Cutter, being used in a tool room at General Electric Co., Chicago.

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* **CHICAGO, U.S.A.**

There's a NEW LOOK and NEW PERFORMANCE in this 1958 Model!



Here's what the new Model 161 Rotary can do for you...

Greater Precision—Dial knob type feed box now permits incremented feeds of .0001 from 0 to .0006 for rough grinding, changing automatically to .0001 fine feed at any point from 0 to .005 before finish size.

Finer Finish—Rugged cradle-type chuck bracket and swivel adjustment minimizes chatter. And vibration-free diamond unit gives wheel a smoother dress.

Easier Operation — Anti-friction table ways give easier manual reciprocation. Four ounce pressure moves the 590 lb. table.

Higher Production—Hydraulic table feed rates infinitely variable from 0 to 10 fpm. Permits smooth slow dressing speed, changeable instantly to rapid traverse or reciprocating speed.

Greater Versatility—A manually operated machine is easily changed over to hydraulic operation simply by adding a power pack.

Less Maintenance—Anti-friction table and base ways are grease packed for life and sealed to exclude foreign matter. Hydraulic table design minimizes spare parts inventory and reduces maintenance and attention.

The 1958 Model 161 Rotary Surface Grinder is ideally suited to all small work grinding operations, on a high production or job-lot basis. Grinds flat, convex or concave surfaces of work up to 6 in. O.D. For complete information, send today for Bulletin 2-161-2 Issue 1.

IT PAYS TO COME TO HEALD!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

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Machinery

JANUARY 1958 **VOL. 64 NO. 5**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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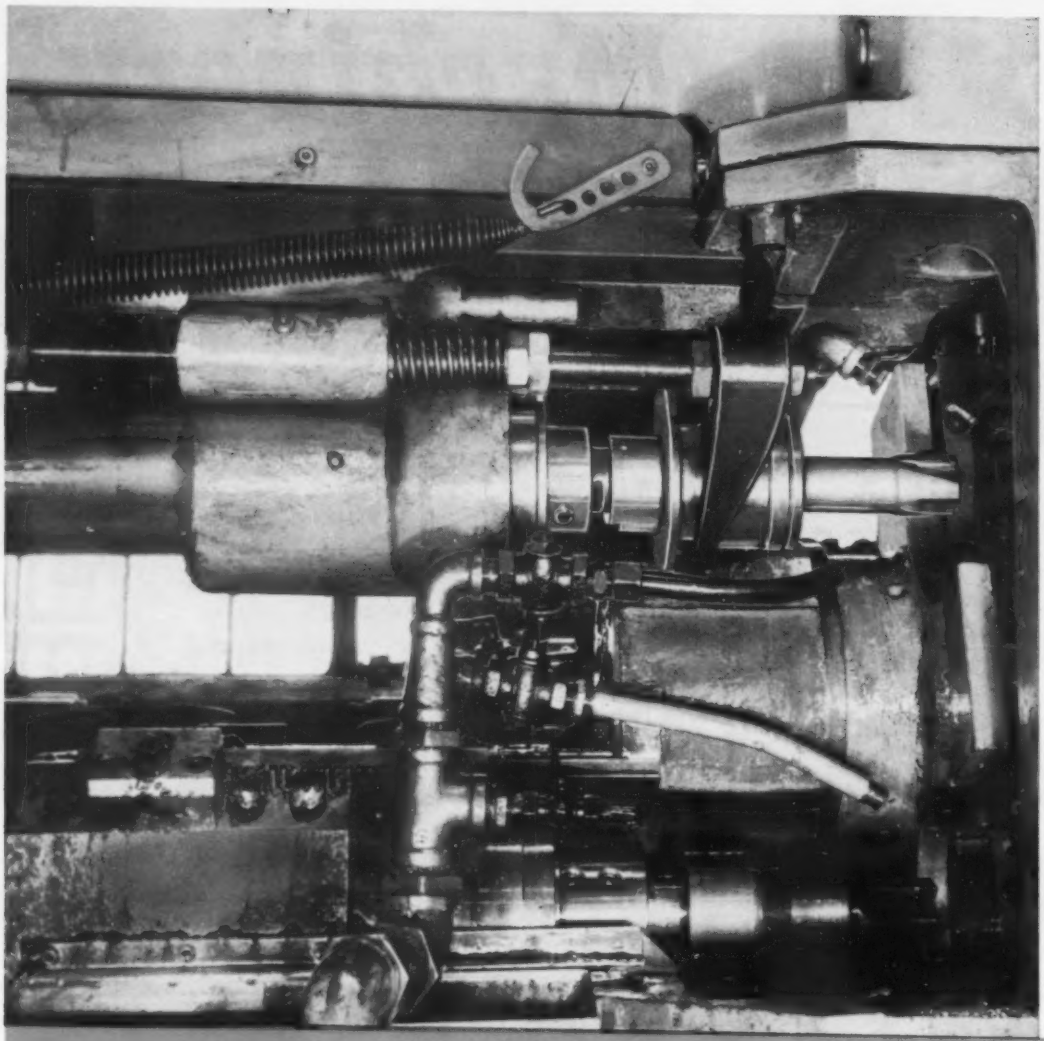
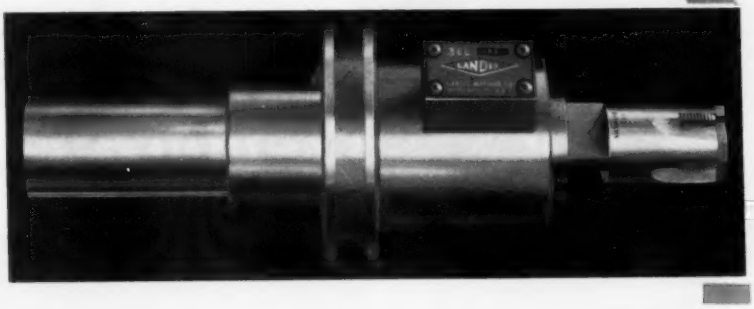


LANDIS TAP

for bar automatics...

3000 pieces between grinds at 140 SFM



A LANDIS, Rotary Style, Collapsible Tap is giving excellent chaser life producing taper threads during high-speed machining runs at the Grabler Manufacturing Co., Cleveland, Ohio.

The 2LL Tap, equipped with a 1½" extra long head; is shown installed in the right-hand third position on a New Britain Automatic machining 350 malleable iron union bodies per hour. Though threading at the high speed of 140 SFM, 3000 1½" 11½ pitch NPT threads are produced between chaser grinds.

LANDIS LL Receding Chaser Collapsible Taps, designed especially for taper threading, feature a receding action that contributes to excellent chaser life. A precision mechanism diametrically recedes the chasers during threading at a rate equal to the desired thread taper. This reduces cutting strains by restricting cutting action to the throat or chamfer section, and provides longer chaser life between grinds. An important additional feature of this receding action is the generation of a truly conical taper thread with no chaser leave off marks.

LL Taps can be furnished for rotary or stationary applications from $1\frac{5}{16}$" to 20" in diameter . . . the 2LL illustrated here, using 5 different Tap Heads, will thread all pipe diameters from 1" to 2½". For more details, write for Bulletin G-95 . . . perhaps your plant has an internal taper problem that may be simplified by a LANDIS LL Collapsible Tap.

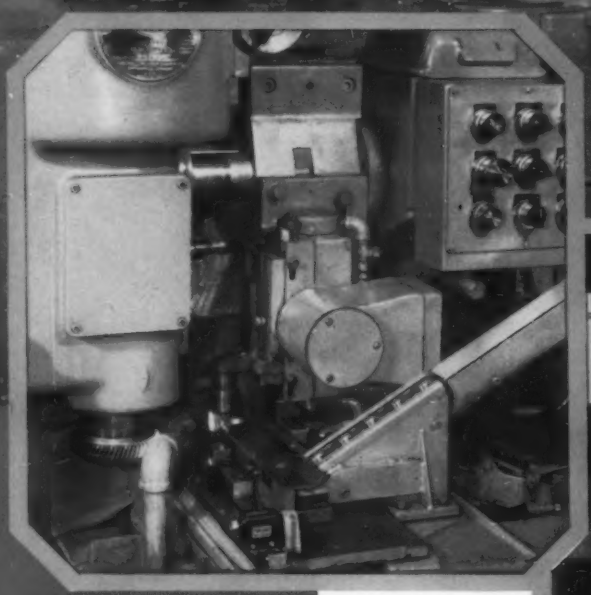
505C

LANDIS *Machine* COMPANY

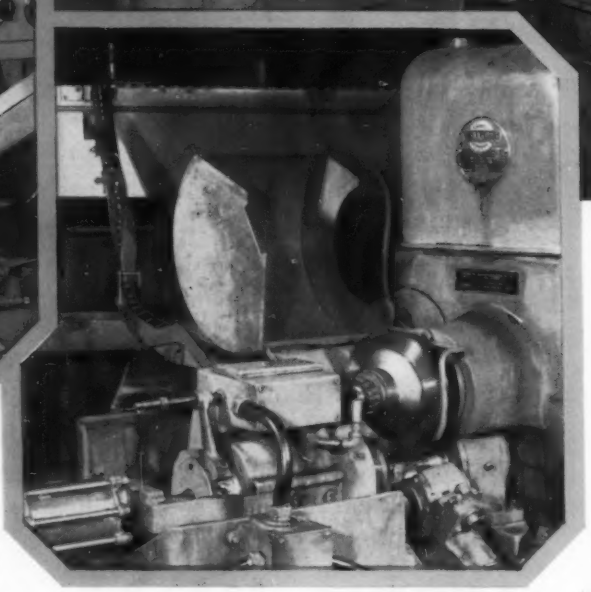
WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT - CUTTING - TAPPING - GRINDING - ROLLING

THE *FORWARD* LOOK . . .



Fellows No. 4GS Gear Shaper with attachments for full-automatic loading and unloading.



Fellows No. 8 Full Tool Shaver set up for automatic loading and unloading.

THE PRECISION LINE

in Chrysler's Fully-Automatic Gear Production Line

Fully-automatic shaping and shaving on Fellows machines: this is "*The Forward Look*" in gear production techniques, adding advanced speed and efficiency to pinion production for Chrysler Corporation automatic transmisions.

Cutting at a speed of 470 strokes per minute, each of 14 Fellows No. 4GS Gear Shapers rough cuts and finishes a 1.286" P. D. pinion in less than a minute. Parts are then automatically conveyed and loaded on Fellows No. 8 Full Tool Shavers for final finishing. Parts are automatically stock-piled in process to spread production evenly over machines.

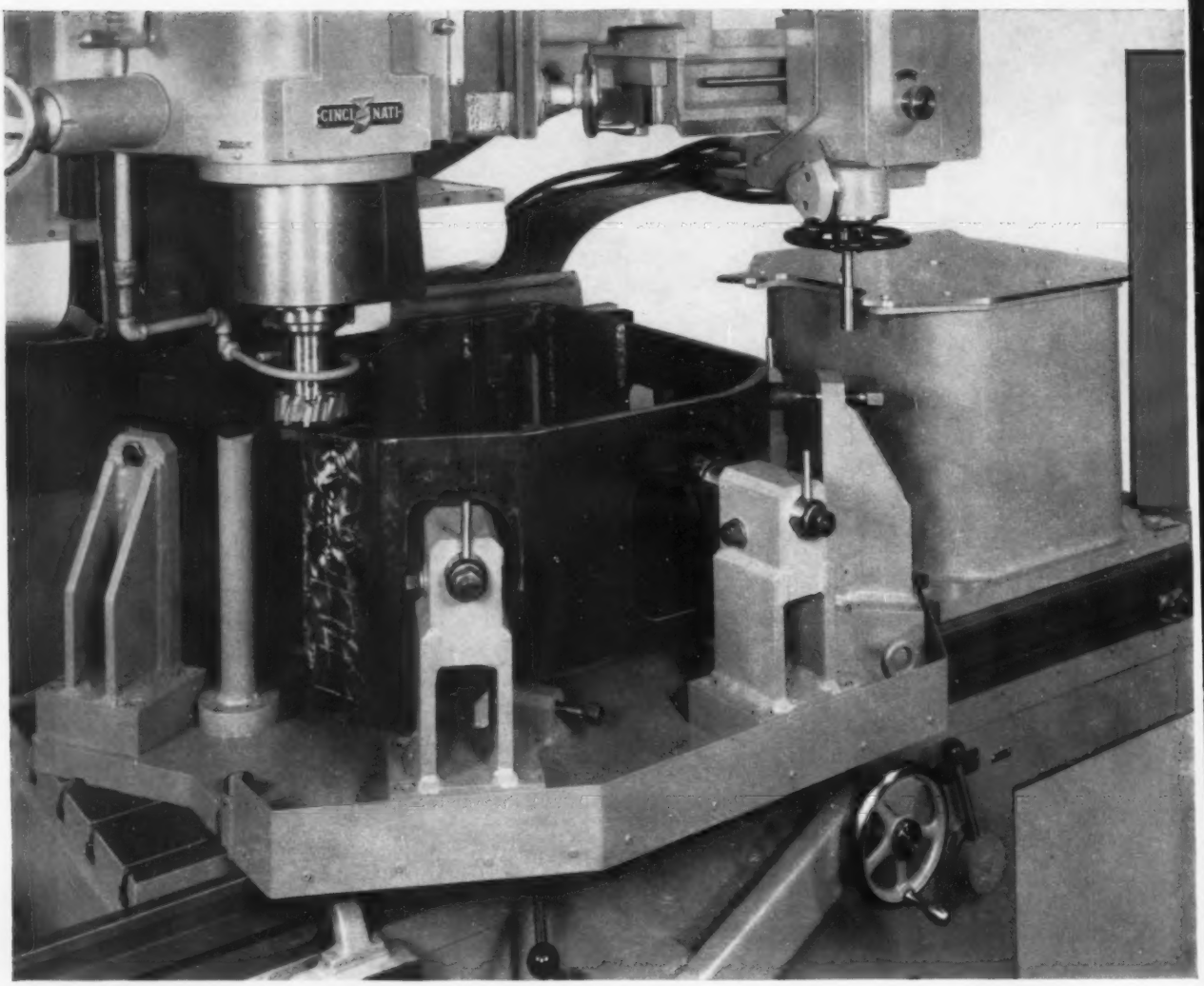
These are the same versatile machines that many manufacturers use for manual production of short runs of gears and other shaped parts! Optional attachments provide any degree of automatic operation desired. Ask your Fellows Representative to show you facts and figures on the cost advantages of investment in modern Fellows machines. A 71-page booklet, "The No. 4GS Gear Shaper," describes and illustrates the machine in full detail, including attachments for automatic or semi-automatic operation. Write, wire, or phone any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Michigan
150 West Pleasant Ave., Maywood, New Jersey
5835 West North Ave., Chicago 39, Illinois
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

25″ x 33″ Profile

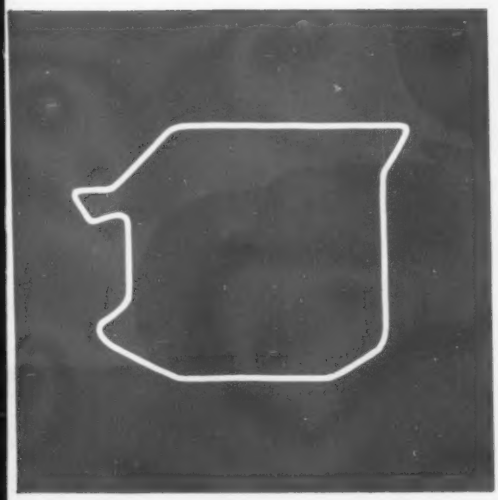
Milled Automatically



Entire profile edge of large weldment is automatically milled in one continuous cut, on this CINCINNATI 28″ Vertical Hydro-Tel Milling Machine, equipped for 360° Automatic Profile Milling. Note how machine handwheels can be swiveled out of the way to accommodate overhang of large fixtures.

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • SPECIAL MACHINE

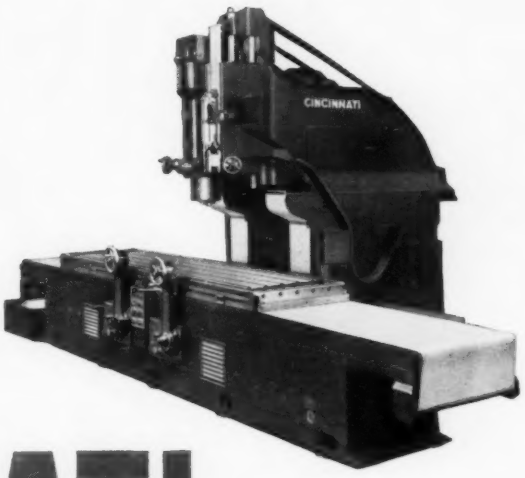
on CINCINNATI 28" VERTICAL HYDRO-TEL . . .



Variety of curves in the above template are scanned automatically by the tracing finger extending from the Hydro-Tel's 360° Automatic Profile unit.

There are two ways to mill large two-dimensional profiles. The hard way, when the operator uses two hands to control table and cross traverse, while keeping his eyes glued on the work and cutter. Or the easy low-cost way, automatic profile milling on a CINCINNATI® 28" Vertical Hydro-Tel like the one illustrated here. This equipment greatly simplifies the operator's job. After he loads the fixture the automatic profiling unit takes charge of the operation, scanning the curvature of the template while automatically controlling the table and cross feed to mill the exact profile of the template. ¶ This production idea can be extended to machine two, three or four parts at one time, with the corresponding two-, three- or four-spindle head. There's no floor under costs when you plan your milling operations on a CINCINNATI Hydro-Tel. Cincinnati builds four machines of this type: 16", 28", 30", 36". All are "spec'd" in Sweet's Machine Tool File. Complete data for the 28" size may be obtained by writing for catalog No. M-1773-3.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



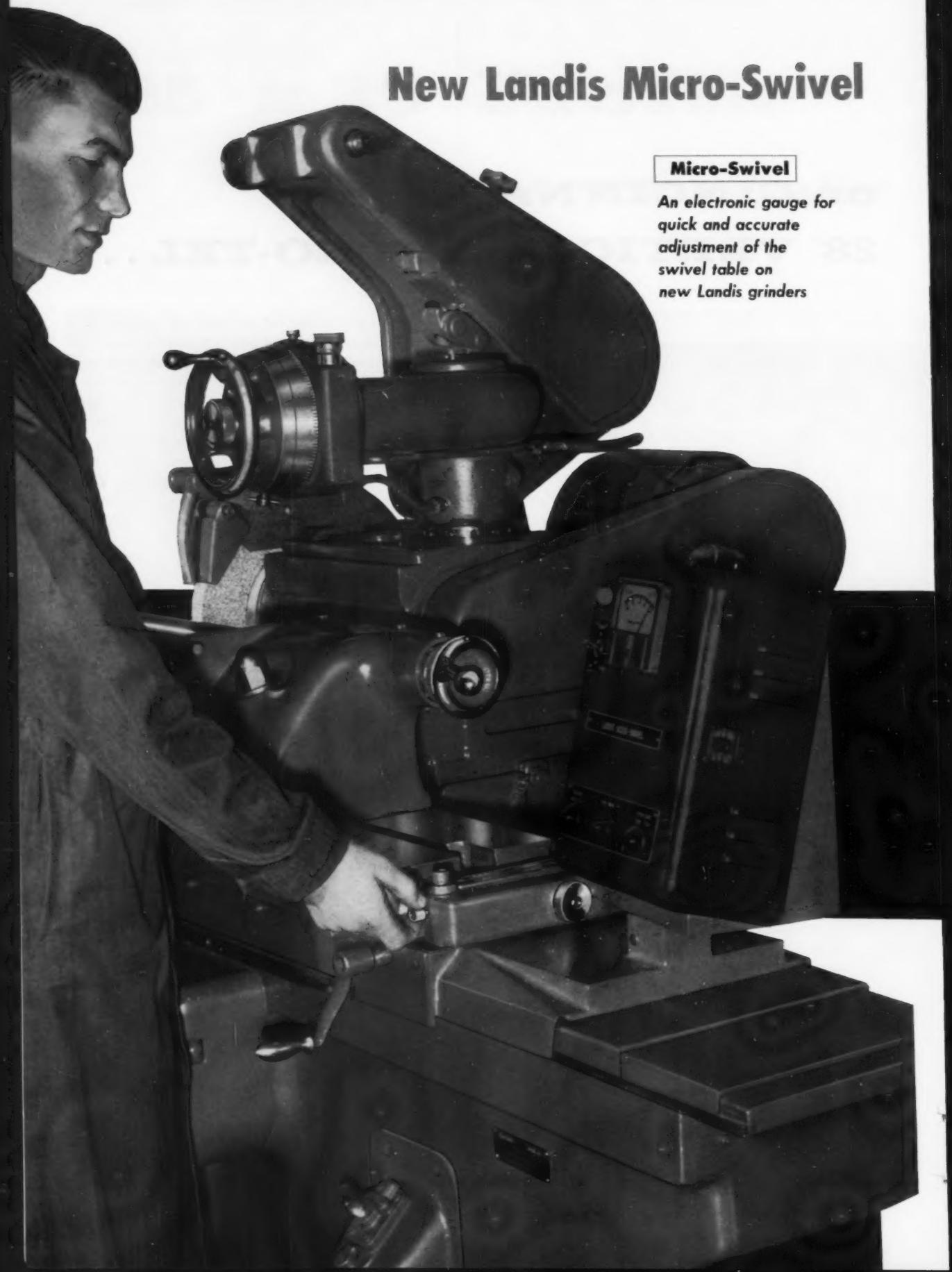
CINCINNATI 28" Vertical Hydro-Tel Milling Machine. General-purpose style illustrated. Can be equipped for die sinking and/or automatic profile milling, or multiple spindle production milling. Catalog No. M-1773-3.

CINCINNATI

TOOLS • METAL FORMING MACHINES • HARDENING MACHINES • CUTTING FLUID • GRINDING WHEELS

For more information fill in page number on Inquiry Card, on page 227

New Landis Micro-Swivel



Micro-Swivel

An electronic gauge for quick and accurate adjustment of the swivel table on new Landis grinders

saves setup time on Landis grinders

gives these time saving benefits

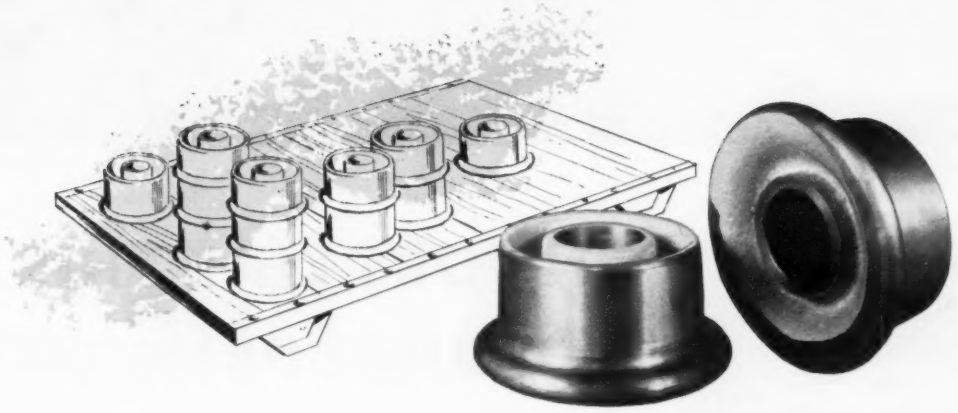
Eliminates cut and try in setup
Gives precision alignment quickly
Reads in "tenths" or "thousandths"
Easy to use; even for unskilled operators

advanced features make Landis Micro-Swivel "best available"

One turn of knob sets detector regardless of table swivel position
Direct reading—no calculations necessary
No pushrods, chucks or set-latches to adjust
Rugged shop-type unit; cannot be jammed
Printed circuit—moisture proof
Separate readings for headstock and footstock ends of table

LANDIS
precision grinders

LANDIS TOOL COMPANY
WAYNESBORO, PENNA.



How Dempster Brothers solved the small-lot problem!

Dempster Brothers, Inc. of Knoxville, Tennessee—well-known makers of Dempster-Dumpster refuse-handling equipment—had a serious small-lot problem. Turning costs on their obsolete equipment were getting completely out of hand. Modernization was a must! But in order to profitably handle their wide variety of jobs ranging in lots from 5 to 200 pieces, they had to select the most versatile equipment possible.

Dempster found their answer in a new Warner & Swasey 3-A Saddle Type Turret Lathe, equipped with a 50 horsepower motor, cross slide taper and thread-chasing attachments and power chuck wrench. On the first job—a 200-piece lot of cast iron rollers (shown above)—production increased 3 to 1 over their old equipment.

Dempster particularly liked their 3-A's:

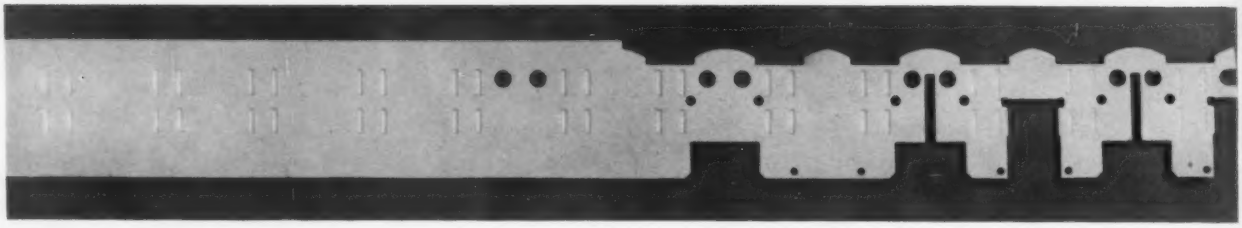
- **FLEXIBILITY AND EASE OF SETUP** which minimized inventory problems for both production and repair parts.
- **QUICK, SIMPLIFIED SPEED CHANGING** of the all-hydraulic headstock, giving optimum speeds for every cut.
- **RIGIDITY AND HIGHER SPEEDS** which permitted heavier roughing cuts and enabled close tolerances (plus or minus .001") to be held with fewer cuts.
- **POWER CHUCK WRENCH CONTROL** that substantially reduced part handling.
- **EASE OF OPERATION** that lessened operator fatigue and cut machine handling time.

Call in your nearest Warner & Swasey Field Representative and let him show how these versatile machines, properly tooled, can handle your jobs more efficiently—boosting both production and overall profits.

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS

...WITH A WARNER & SWASEY

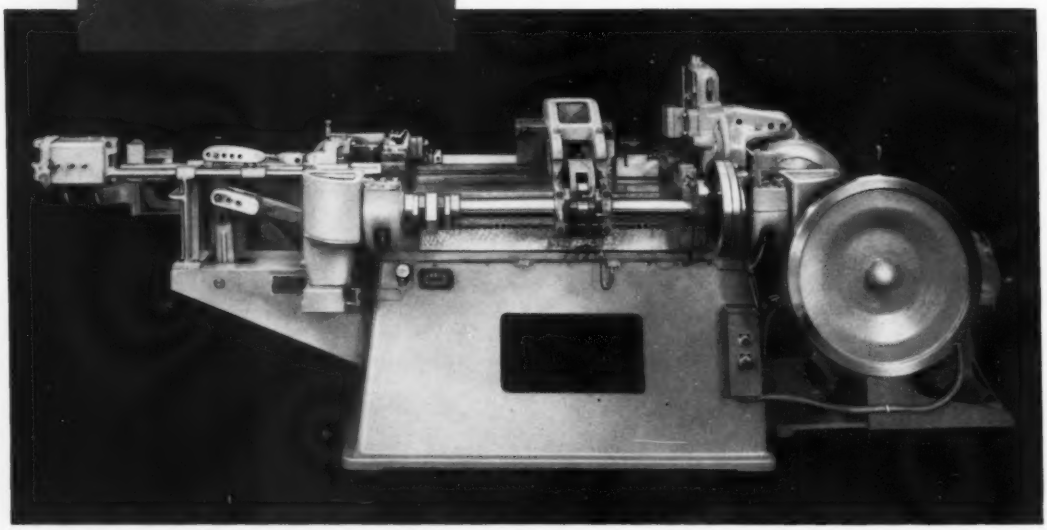
WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

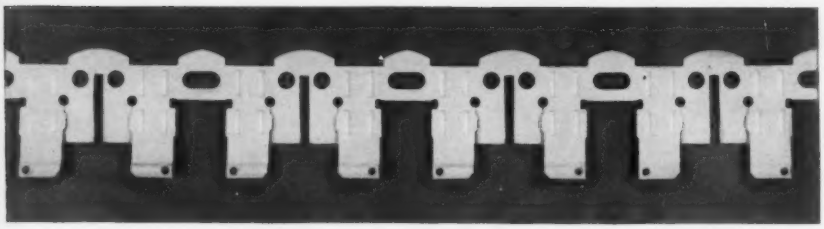


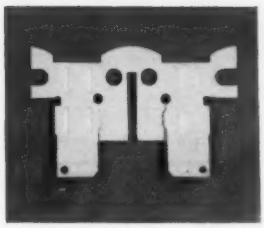
ON JOBS LIKE THIS CORBIN TURNS TO

The Corbin Latch Bolt Retractor shown at left illustrates the unique ability of the U. S. Multi-Slide to produce thousands of uniformly precise parts—faster and better. Completely formed to close tolerances from strip metal, this part is non-jamming, self-aligning and practically indestructible. Thus, it imports to Corbin Locksets the famous "velvet glide" knob action, long life and trouble free service—qualities which were found previously only in higher priced custom units, but which are now, thanks to U. S. Multi-Slides, an integral part of every Corbin Standard Duty Residential Lockset.

Below: The U. S. No. 35 Multi-Slide Machine used, with appropriate tooling, to produce the Corbin Latch Bolt Retractor shown above.







U.S. MULTI-SLIDES®

The Corbin ball bearing latch bolt retractor is just one of a multitude of stampings which can be produced—complete, without secondary operations, handlings or inspections—on U. S. Multi-Slide Machines. In the U. S. Multi-Slide, a combination of motions built in to the machine itself greatly simplifies the designing of tools to fabricate precision formed metal stampings. Because these motions are part of the standard machine equipment, it is not necessary to incorporate complicated movements into the dies. Standard equipment on the machine includes: ram action for cutting, piercing, trimming, embossing, etc.; a four-slide forming position; and vertical movement for stripping and transferring. U. S. Multi-Slide Machines are built in four sizes, and on the three larger units it is possible to use two or more rams simultaneously. These features make the U. S. Multi-Slide extremely versatile in the automatic, high-speed production of all types of formed metal stampings.

If you want to produce parts uniformly . . . at high speeds . . . and to close tolerances, write for a copy of Bulletin 15-M or send part drawings or samples for our recommendations.

U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides—U. S. Multi-Millers

U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

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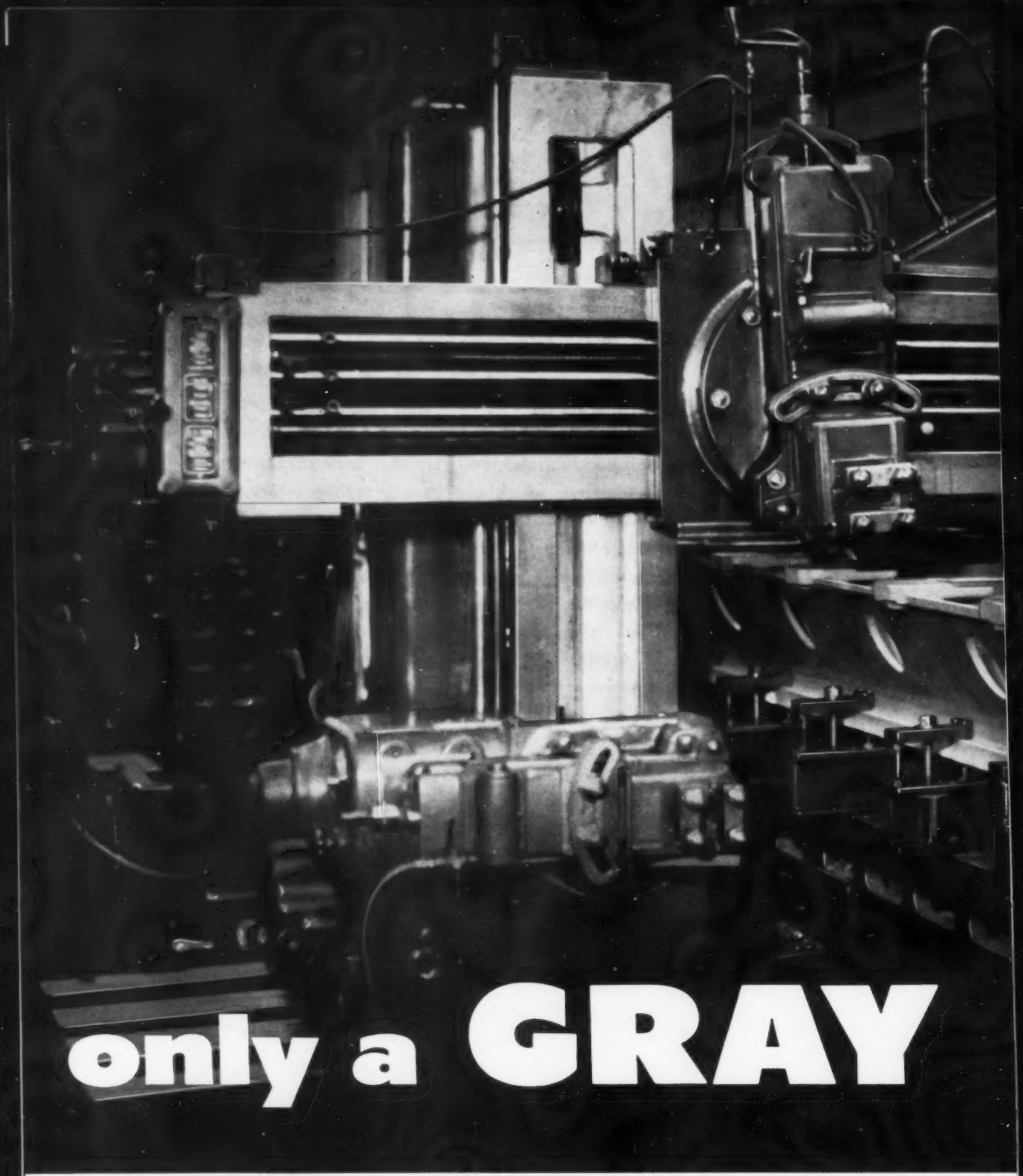


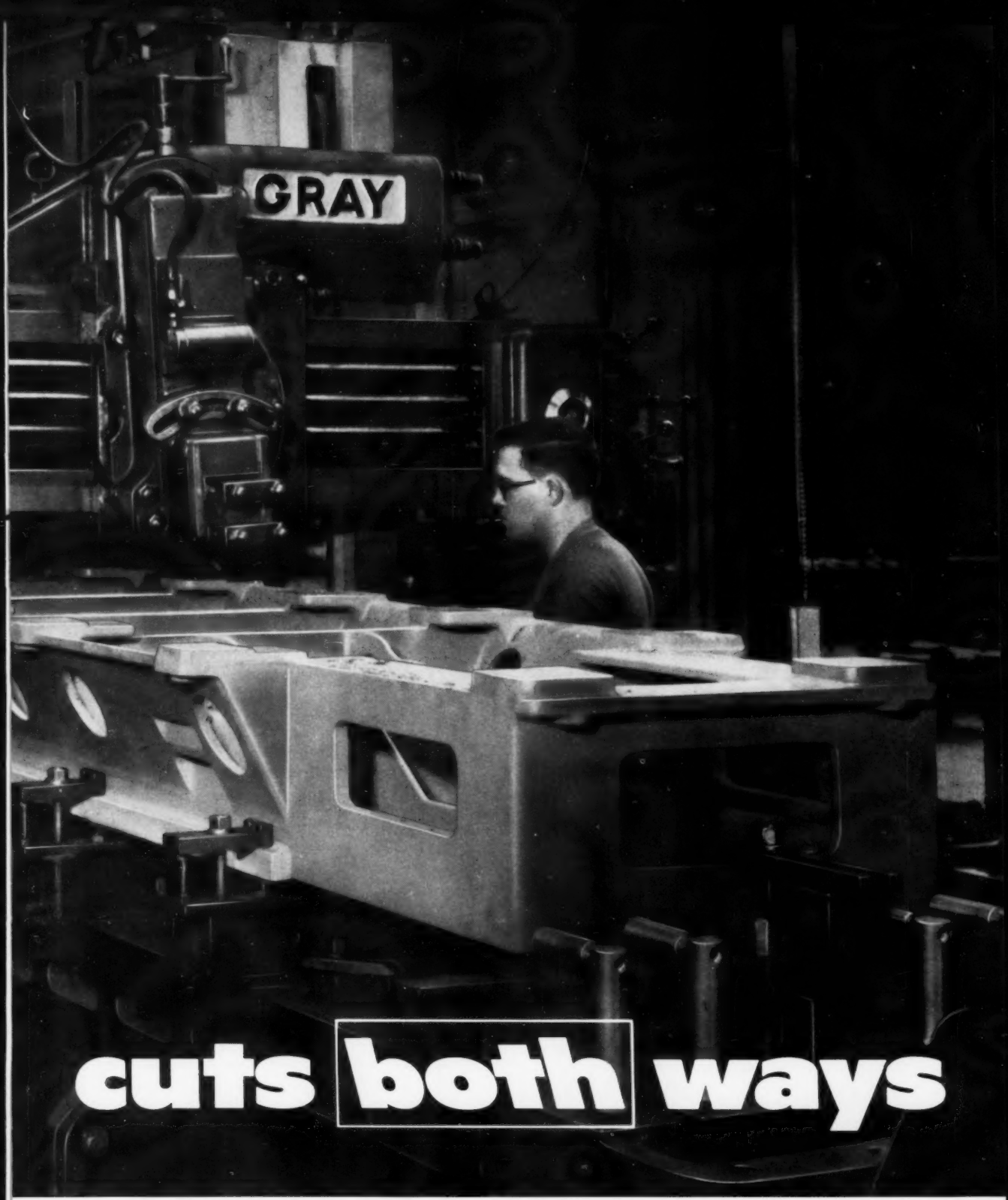
only a GRAY

Cuts going—cuts coming . . . that's "double-cutting" with the GRAY Universal Planer. At Textile Machine Works, Reading, Pennsylvania, this new GRAY is pictured double-cut carbide planing a Tricot Machine Base. Former floor to floor time of 62 hours has been slashed to 12 hours by the enormous productive potential of the new GRAY that cuts both ways.

The G. A. GRAY Co., Cincinnati, Ohio.

heavy-duty planing

The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.



cuts both ways

double-cutting

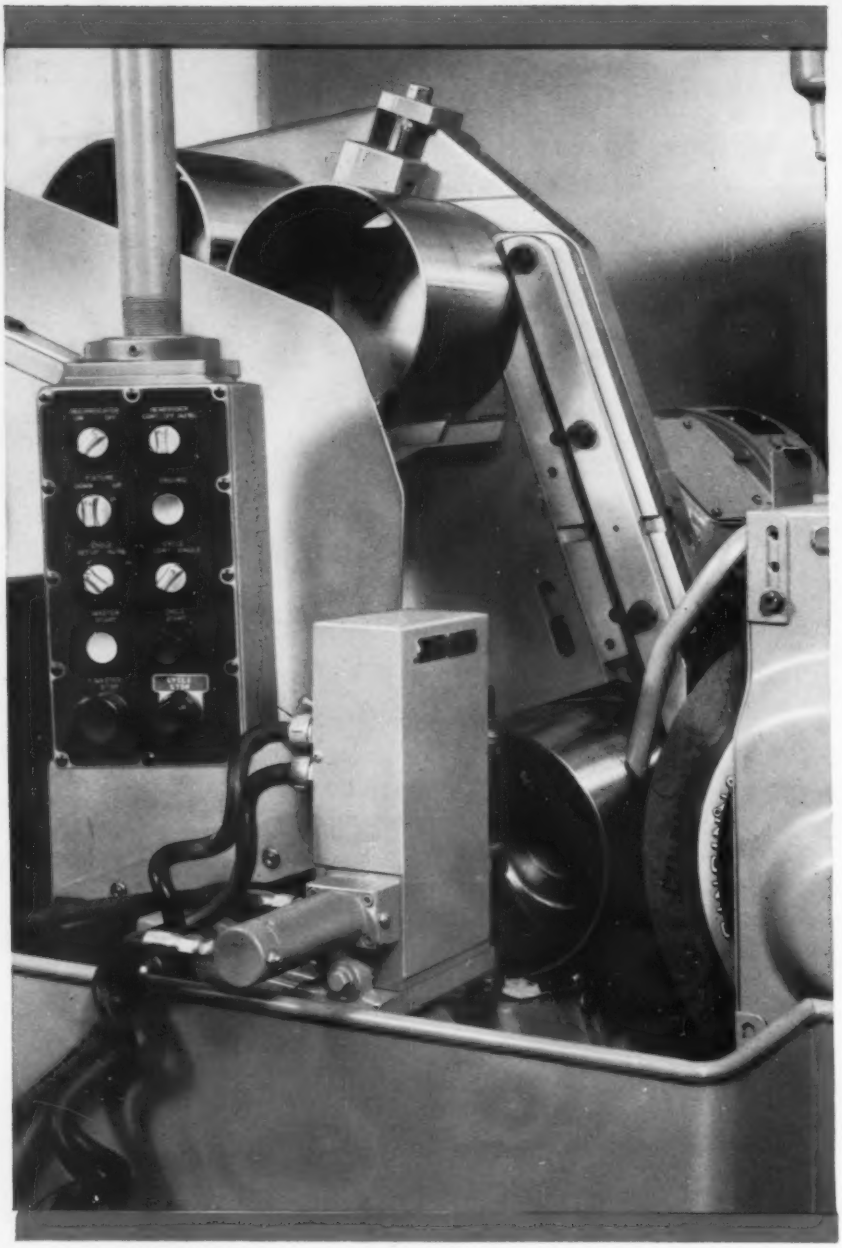
The flick of a lever, the touch of a button permits double-cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.

triple-cutting

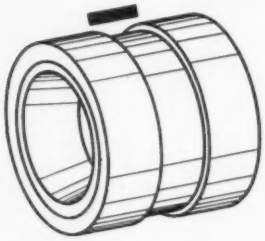
Rough and rough-finish plane at the same time. Rough by double-cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.



Large



Drawing of part. Diameter ground is indicated by heavy line.

Part name . . . . anti-friction ring

Production . . . . 40 per hour for 10" rings

FILMATIC

Micro-Centric grinding applied to large parts up to 10" diameter. Loading and grinding are automatic for the operation of grinding a narrow section to perfect roundness.

CINCINNATI

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE

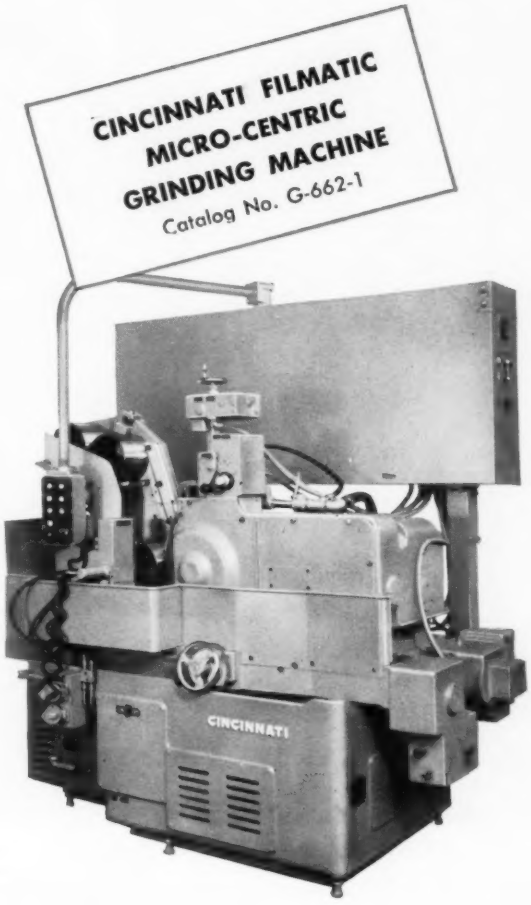
Anti-Friction Bearing Rings

are ground perfectly round

on the Cincinnati Filmatic Micro-Centric

Perfect roundness is a tough specification for any high production grinding operation. And the larger the part, the more difficult the specification becomes for ordinary grinding methods. A prominent manufacturer of anti-friction bearings solved the problem by enlisting the aid of Cincinnati Grinding and Automation Specialists, and performing the job of grinding the center section of 10" diameter rings on a CINCINNATI® FILMATIC No. 2 Micro-Centric. ¶The machine is tooled up for automatic production, and includes several cost-reducing features such as automatic loading fixture, adjustable for 6" to 10" diameter range . . . automatic reciprocation for grinding wheel spindle with interlock for truing . . . automatic cross feed compensation to maintain constant length of cycle. ¶This equipment is typical of the fine grinding machines and modern tooling available at Cincinnati. Our specialists are ready to give you the benefit of their experience in six distinct types of precision grinding: centertype, centerless, chucking, Micro-Centric, centerless lapping, roll. Make Cincinnati your headquarters for fine standard and special precision grinding machines. It's to your advantage to do so.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO



GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

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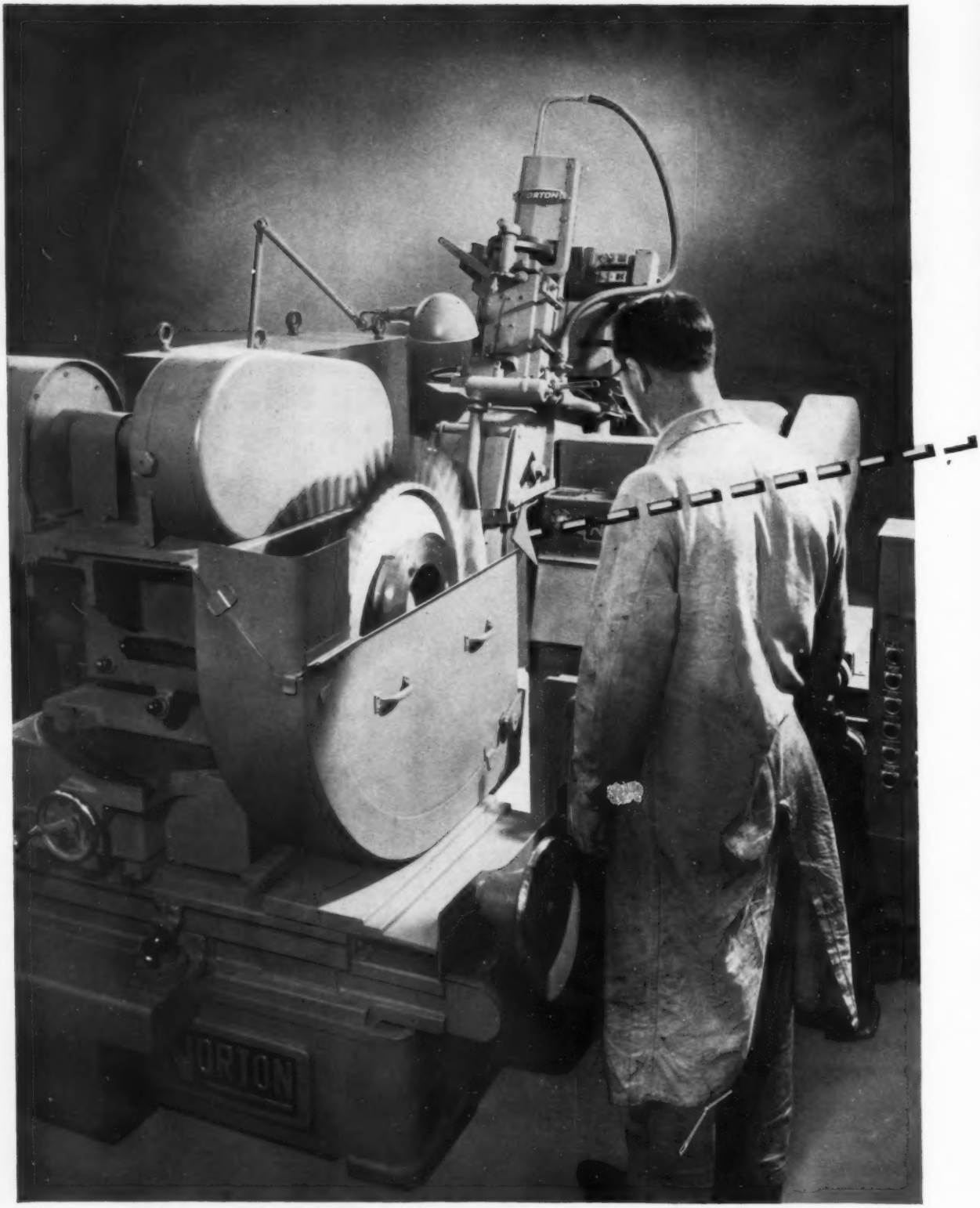


Grinding Short Parts With Large Diameters, like this compressor wheel, is a much faster and easier job on the Norton 42″ Hi-Swing Semiautomatic Chucking Grinder. To the standard advantages of Norton semiautomatic design this machine adds many advanced features of its own for easier loading and unloading and faster, simplified operation. Results: less tiring work for your operators — a consistently higher production rate for *you*.

Now you can grind large diameter, short parts *fast!*

The Norton 42" Hi-Swing Semiautomatic Chucking Grinder features speed, adaptability and easy operation

For "Hi-Swing" in the name of the Norton 42" Hi-Swing Semiautomatic Chucking Grinder you can substitute "high speed," "high efficiency" or "high production" — and you'll be right every time!

Designed especially for rapid, accurate grinding of large diameter, short parts — such as jet engine compressor wheels and many similar components — it is particularly suited for jobs where both external and internal grinding are required. It takes work held by chucks, face plates or special fixtures and permits several surfaces to be ground without disturbing the set-up.

For easy operation

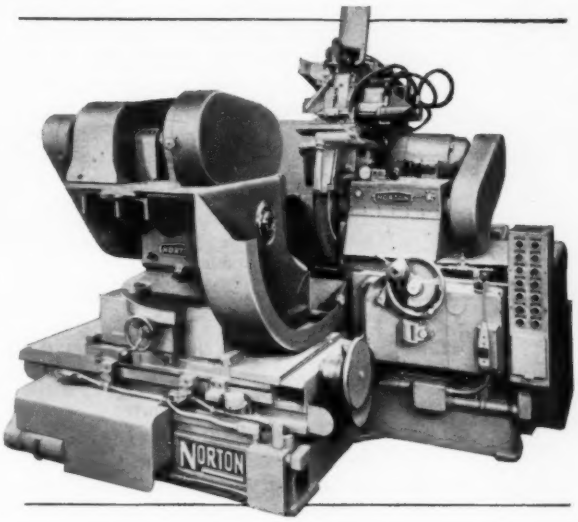
- Automatic or manual work rotation control by simple selector switch.
- Automatic or manual coolant flow control.
- Automatic feed cycle under one-lever control.
- Automatic wheel truing under push-button control.
- Excellent clearance conditions for loading and unloading.
- Maximum visibility of grinding action.
- All controls within easy reach of operator.
- Graduated wheel feed handwheel with "click-count" index.
- Power work head table traverse with automatic reverse by hydraulically operated rotating screw.

The automatic functions of the Hi-Swing Grinder combine to assure you a pre-determined, consistent rate of output. Advanced features like the wheel truing device greatly reduce the requirement of operating skill. And the careful consideration of the operator in the over-all design is still another factor that cuts down fatigue, saves time and enables continuous high production.

In your own plant

you'll find this pace-setting grinding machine a real profit-boosting production tool on many jobs that are now using up too much of your operators' time — and *your* money.

See your Norton Representative for further details on the 42" Hi-Swing Semiautomatic Chucking Grinder. Or write for Catalog. And remember: only Norton offers you such long experience on grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



Designed For Easy Maintenance, the 42" Hi-Swing Grinder has all pumps, motors and filters mounted outside . . . pressure relief valves for hydraulic and ways lubrication systems conveniently placed . . . ways lubricant flow control valves at end of base . . . hinged wheel guard cover eases change . . . ramped coolant tank outlet speeds clean-cut . . . electrical controls in raised enclosure for stand-up inspection.

To Economize, Modernize With NEW

NORTON

GRINDERS and LAPPERS

Making better products . . . to make other products better

District Sales Offices:
Worcester • Hartford • New York • Cleveland • Chicago • Detroit

For more information fill in page number on Inquiry Card, on page 227

These Oakite shortcuts speed your metal cleaning

1 **Cleaning and rustproofing**—*in one washing operation*

Oakite Composition No. 98 (used cold or hot in one-stage or two-stage washing machines) removes cutting oils and chips—while it leaves a thin film that protects steel against rusting between operations or during temporary storage.

Excellent for cleaning before inspection: the metal is cool for immediate handling and the film (too thin to affect measurements) prevents finger prints from corroding highly finished surfaces.

One auto manufacturer uses No. 98 in seven plants for cleaning and rustproofing brake cylinders, camshafts, connecting rods, crankshafts, cylinder heads, flywheels, push rods, tappets, wrist pins, etc.

2 **Stripping pigmented paints**—*with no need for pickling before repainting*

Oakite Rustripper saves money in paint shops by doing a complete stripping job in one operation. It eliminates extra pickling and neutralizing to remove the metallic pigments, phosphate coatings and rust that prevent successful repainting.

A television manufacturer says "We formerly took 25 minutes to strip rejected cabinets, then had to pickle to remove tarnished phosphate coatings. Today 10 minutes in Rustripper strips the same cabinet so bright and clean you can't tell it from new. Eliminates pickle, neutralize and rinses."

An auto parts maker uses Rustripper for continuous conveyor line stripping. "Cycle of 1 minute and 50 seconds works like a charm stripping paint and incidental rust from rejects and hooks."

3 **Cleaning, derusting and descaling**—*in one alkaline tank*

Oakite Rustripper saves money in plating shops by removing rust or heat scale at the same time it removes oil and other soils. Alkaline pickling with Rustripper avoids hydrogen embrittlement, etching of machined surfaces and other disadvantages of acid pickling. Rustripper is also used for precleaning or electrocleaning in plating lines.

An aircraft manufacturer who formerly sand blasted to remove heat scale says "Now the scale is removed in 30 minutes in a boiling soak in Rustripper."

A job plater who adds Rustripper to his reverse-current cleaner in an automatic plating machine, says "We used to clean 45 seconds. Now 20 seconds cleans sparkling bright . . . saves precious time . . ."

FREE Write for booklets

OAKITE PRODUCTS, INC., 26 Rector St., New York 6, N. Y.

Send me the FREE booklets indicated below:

1 "For Power Washers—Oakite Composition No. 98"
2 "Here's the best shortcut in the field of organic finishing"
3 "Here's the best shortcut in the field of electroplating"

NAME_____

COMPANY_____

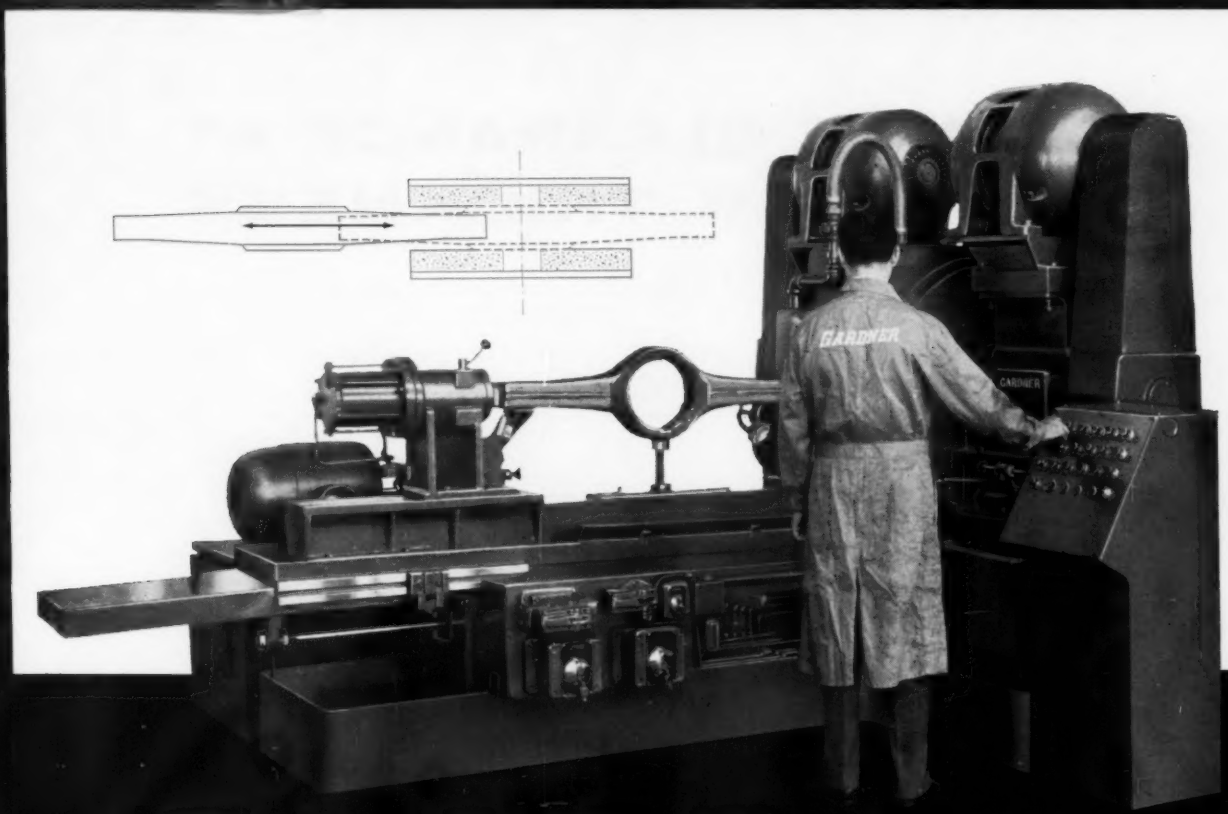
ADDRESS_____

Technical Service Representatives in Principal Cities of U. S. and Canada

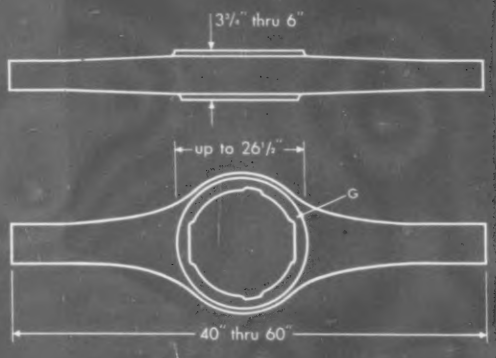
Export Division
Cable Address: Oakite

OAKITE

For more information fill in page number on Inquiry Card, on page 227



Disc grinds two sides of large axle housing in one operation



Special fixturing reduces cost over one side at a time grinding

tooling

hydraulic sliding work table
air-clamping fixture
hydraulic head feed for face cutting
automatic lubrication
fixture mounted dressers

production data

Part:	axle housing
Operation:	grinding banjo section
Rate:	48 pieces per hour
Stock Removal:	1/32" to 1/16"
Disc Size:	36" x 3" x 20"

GARDNER

precision disc grinders

BELOIT, WISCONSIN

SET KNIFE CLEARANCE AT 8% OF METAL THICKNESS

Turning hand crank "A" changes knife clearance "C". This is indicated on gauge "B". There are no bolts to loosen, no parts to move. The adjustment is easily made in 10 seconds.

8% is a good figure to remember when shearing mild steel. By adjusting the clearance between the knives to 8% of the thickness of steel being cut, you will get the best cuts and the knives will stay sharp longer.

Because of the importance of having the right knife clearance for every shearing job, Steelweld Shears were designed to make this adjustment extremely easy. In fact, it can be made in 10 seconds. Consequently, it becomes a natural routine part of a shear operator's job.

You will find this feature invaluable if you shear various thicknesses. It eliminates the need of working with some fixed compromise knife clearance setting with resultant cuts that vary from the ideal more or less as the knife adjustment is off from the correct setting.

Steelweld Shears are the most modern on the market today with more features that make for speed, accuracy and long trouble-free operation. Some of their fine features are not obtainable in any other machine.

Series 8D-12 Steelweld Shear for cutting steel to 12' x ½". A stainless steel plate 7' x ⅜" is shown being cut. Various thickness plates, as well as heavy steel grating, are also cut on this machine, which is in a West Coast plant. Knives on this hard-working shear last 3 to 6 months before they need to be turned to another cutting edge.

Write for free copy of Catalog No. 2011
Gives construction and engineering details

STEELWELD
PIVOTED BLADE **SHEARS**

STEELWELD DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 5454 E. 282 ST. • WICKLIFFE, OHIO

Winner by three points!

The goals are always in *your* favor when you have CIMCOOL° Concentrate on the job in your plant. Here's why CIMCOOL leads the league—actually is the largest selling chemical cutting fluid in the world—winning by three big points:

CIMCOOL LOWERS COSTS because it's longer lasting in machines. Thus, it reduces downtime and cuts labor costs for cleaning and changing.

CIMCOOL DOES A BETTER JOB because of its chemical lubricity. It permits faster speeds and feeds, for it combines friction reduction and cooling capacity in a degree never before attained by old-fashioned coolants.

CIMCOOL IS CLEAN, doesn't soil hands or clothing. It contains no skin irritants. It leaves no slippery film on shoes, floors, machine or work. It can't smoke, can't burn, and virtually eliminates rancidity and foul odors.

So get in the winning column. See your CIMCOOL distributor. He'll give you full information on *all* the advantages of CIMCOOL Concentrate—as well as details on the entire family of CIMCOOL Cutting Fluids.

Or contact us direct and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

CIMCOOL CUTTING FLUIDS

CIMCOOL Concentrate—The famous pink fluid which still covers 85% of all metal cutting jobs. Effective, economical and clean.

CIMCOOL Tapping Compound—Permits the use of highest tapping speeds and increases tap life amazingly.

CIMPLUS The transparent grinding fluid with exceptional rust control. Also used for machining cast iron and as a water conditioner with CIMCOOL Concentrate.

CIMCUT Concentrates — For jobs requiring oil-base cutting fluids. Added to mineral oils, they give economical mixes for higher speeds and feeds.

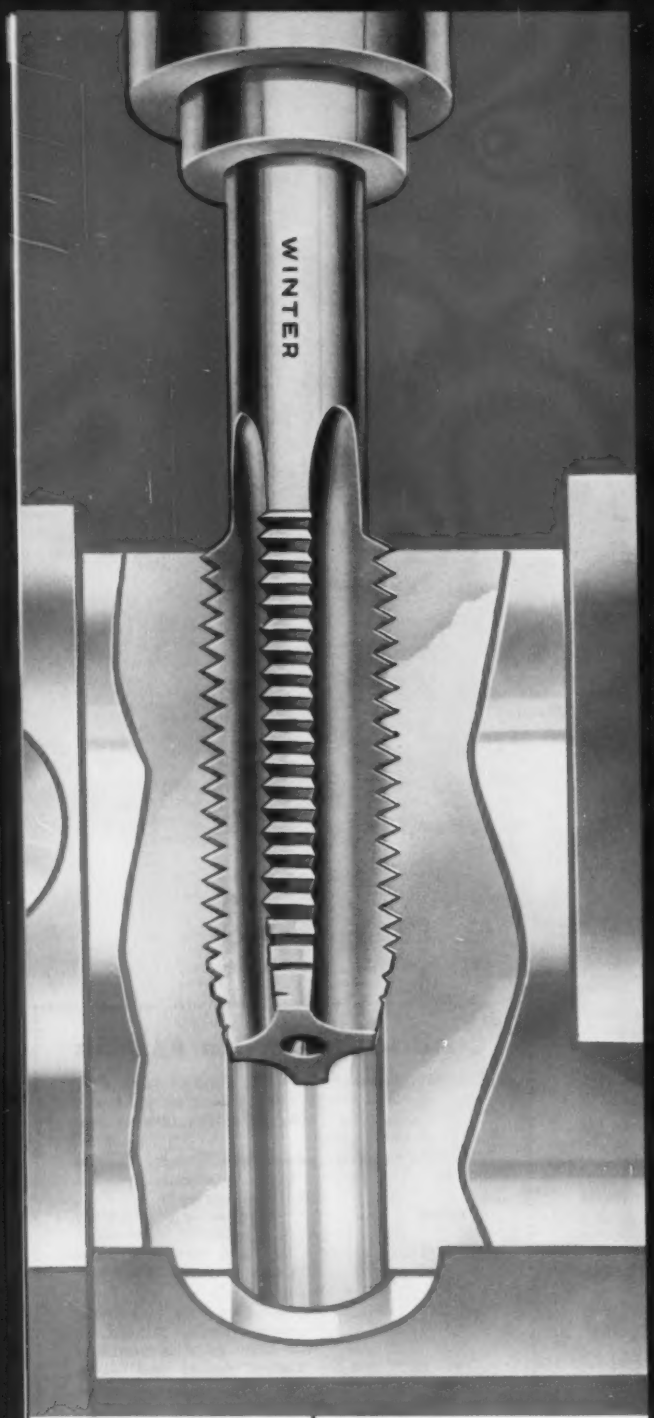
CIMCOOL Bactericide — The most effective agent yet developed to overcome rancidity and foul odors.

CIMCOOL Machine Cleaner — The two-phase non-corrosive cleaner that removes grit, dirt, slime and oil.

CIMCOOL Cutting Fluids

for 100% of all metal cutting jobs

PRODUCTION-PROVED PRODUCTS OF THE CINCINNATI MILLING MACHINE CO.

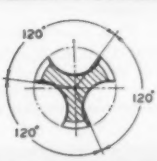


To satisfy your higher standards of today — *and of tomorrow* — Balanced Action tapping

The tempo of production is speeded up. You call on your machines, and on your tools, to meet new standards of volume-plus-accuracy.

More than ever before, then, it pays to use the taps designed and built to operate with Balanced Action. *All Winter taps, both standard and special, are Balanced Action taps.*

CALL YOUR DISTRIBUTOR for standard and special WINTER Balanced Action Taps, Dies, and Gages.

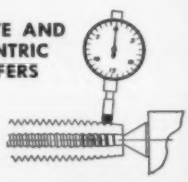


EXACT FLUTE SPACING

UNIFORMITY OF FLUTE CONTOURS

PRECISION CHIP DRIVER CONTOURS

ACCURATE AND CONCENTRIC CHAMFERS



WINTER

WINTER BROTHERS COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.

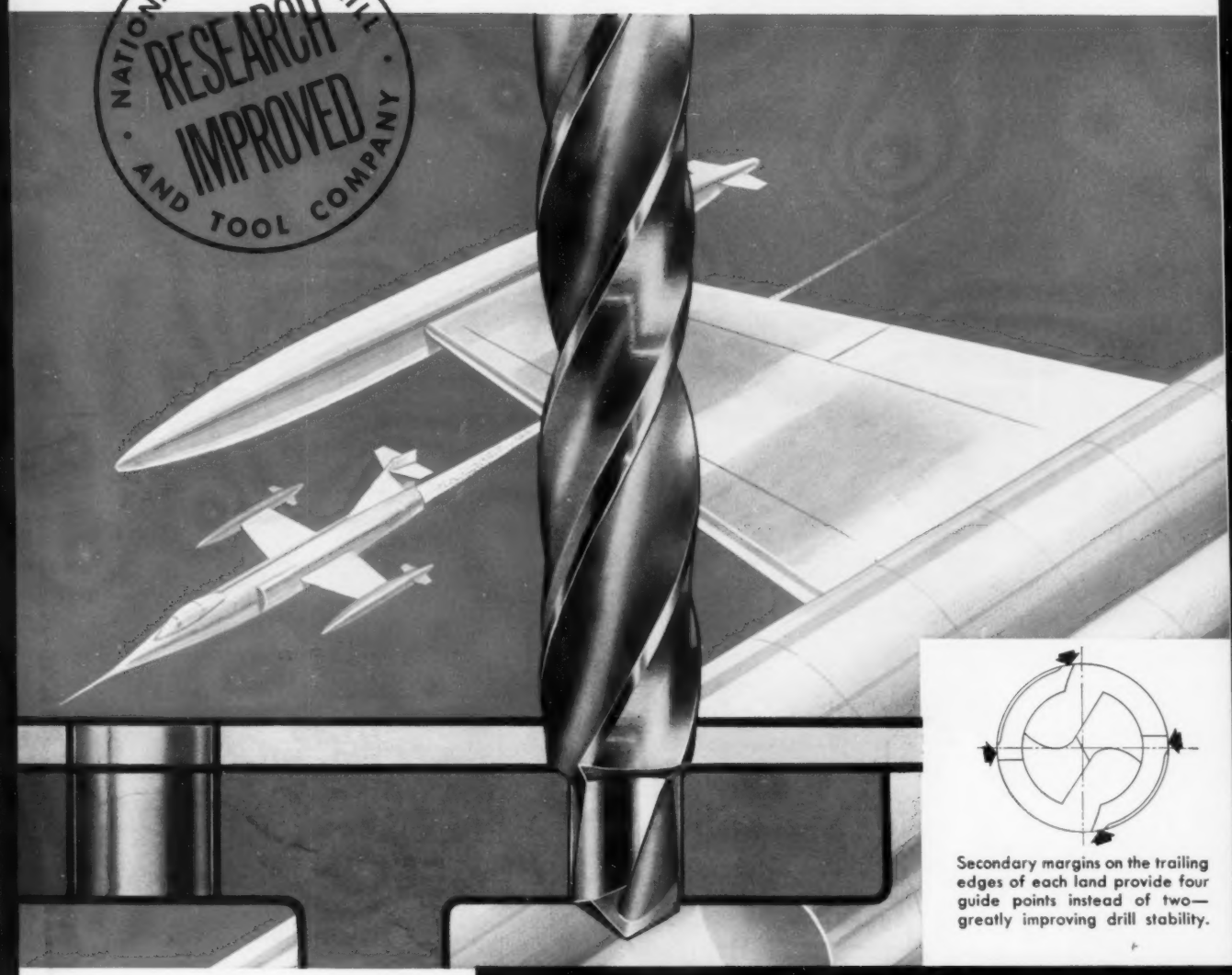
"Research Improved" means *modern* metal cutting

A typical example of cost-cutting brought about by a National "Research Improved" design:

Production of accurate holes, in terms of size, roundness and straightness, is now being obtained in many applications with National Double Margin Step Drills. Guiding, roughing and finishing—requiring two or three steps with conventional tools—becomes a single operation.

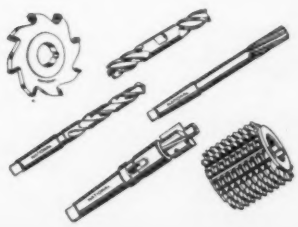
They perform accurately where guide bushings cannot be used (as shown below)—are very successful for portable drilling.

NATIONAL TWIST DRILL AND TOOL COMPANY · RESEARCH IMPROVED ·



Secondary margins on the trailing edges of each land provide four guide points instead of two—greatly improving drill stability.

CALL YOUR DISTRIBUTOR for NATIONAL twist drills, reamers, counterbores, milling cutters, end mills, hobs, carbide and special tools.



National

NATIONAL TWIST DRILL & TOOL · ROCHESTER, MICH., U.S.A.

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York
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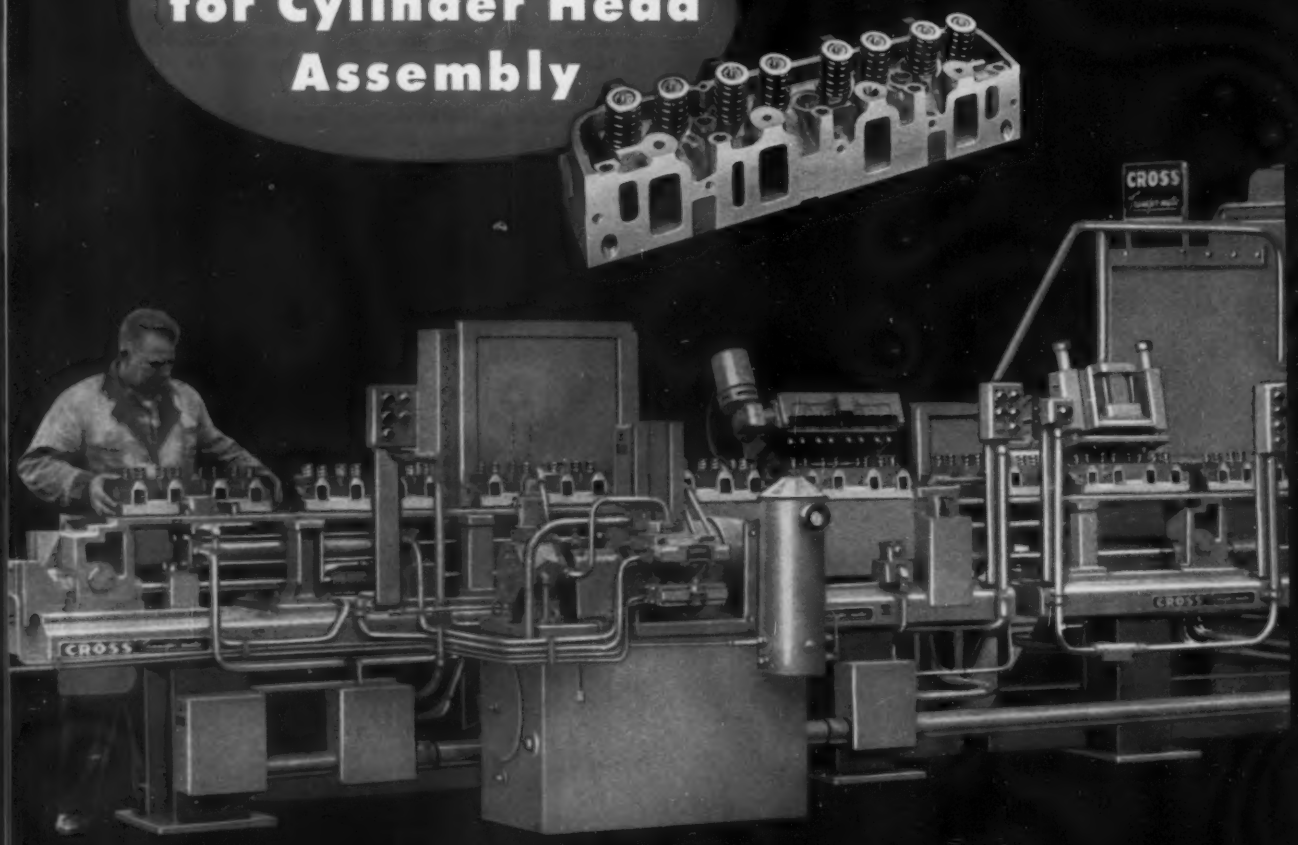
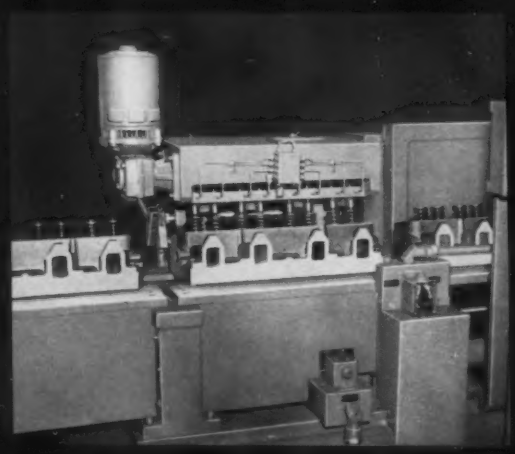
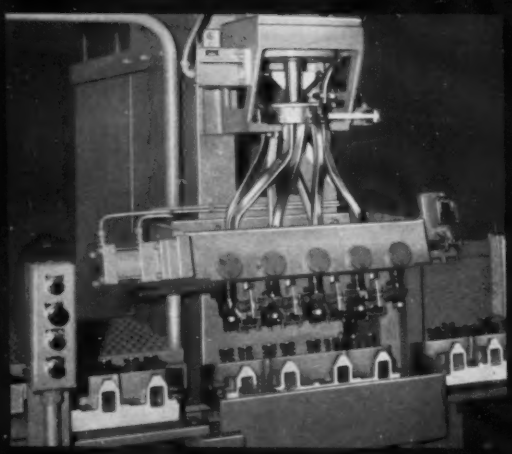
Automation for Cylinder Head Assembly



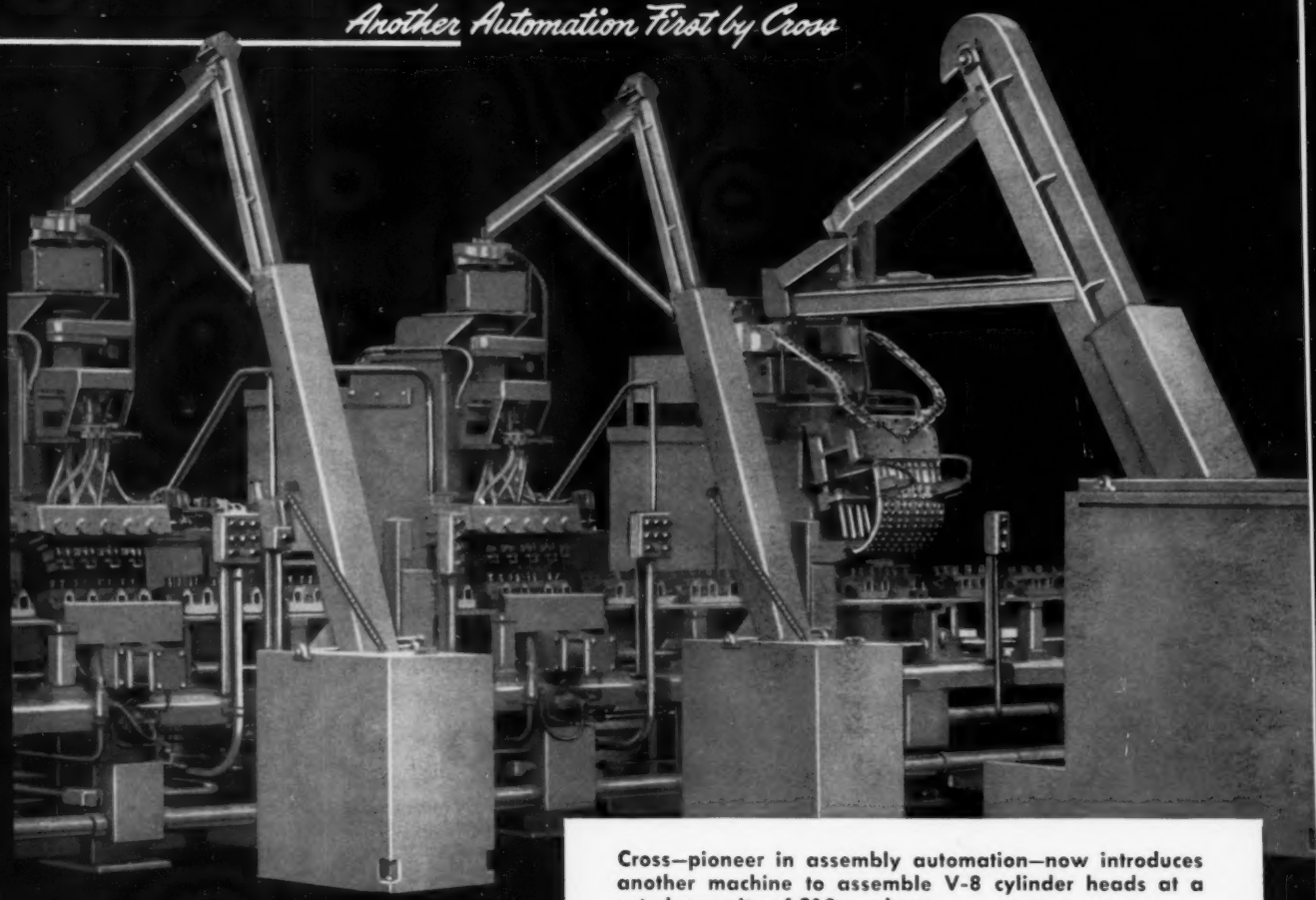


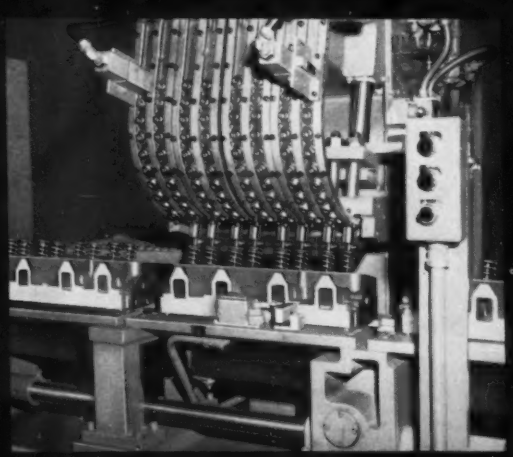
Station 25: Valve "popping".



Station 17: Automatic assembling of valve locks.

Another Automation First by Cross





Station 13: Automatic assembling of valve spring retainers.

Cross—pioneer in assembly automation—now introduces another machine to assemble V-8 cylinder heads at a rated capacity of 310 per hour.

Cylinder head castings with intake and exhaust valves in place are loaded automatically at Station 1. At Stations 3, 4, and 5, rubber grommets are placed over the valve stems. At Station 7, an inspection is made for faulty valves and grommet positioning. If necessary, heads are removed, repaired and returned at Stations 8, 9, and 10. Valve springs, spring retainers and spring retainer sleeves are automatically assembled at Stations 11, 13, and 15 respectively. Valve locks are automatically assembled at Stations 17 through 23 with standby units for manual assembly at Stations 19 and 23. At Station 25, all valves are "popped" before unloading the finished assemblies at Stations 27, 28 and 29.

A unique feature of the machine is the transfer mechanism which lifts and carries the parts between stations to eliminate pallet fixtures used by older assembly machines.

Building block construction provides flexibility for engine design changes and for additional automatic assembly devices of the future.

Like other Cross machines, all parts—even tooling details—are made to interchangeable tolerances for fast, easy maintenance. Other features include construction to JIC standards and automatic lubrication.

Established 1898

THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

BORE! DRILL! MILL!

- ***Extreme overall machine rigidity***
- ***Broad working range***
- ***Unequalled machining versatility***

...plus G & L exclusive design advantages make 30 Series table-type Horizontals your best buy

REMARKABLE ease and speed in centralized operation . . positive, foolproof mechanical control . . . outstanding machine rigidity for any rough or precision boring job within their capacity! That's what you get with versatile Giddings & Lewis 30 Series table-type Horizontal boring, drilling and milling machines.

Because these Horizontals can bore, drill, mill, tap, ream, counter-bore — do so *many jobs* in fewer setups, they are one of the most profitable machine investments you can make.

For maximum boring accuracy requiring saddle feed, a 40 to 1 gear reduction to the saddle motion provides 18 additional feeds (.0125" to .625" per minute) for every spindle speed. Other features include convenient turnstile-mounted depth gauge for control of spindle travel — manual spindle reverse for tapping.

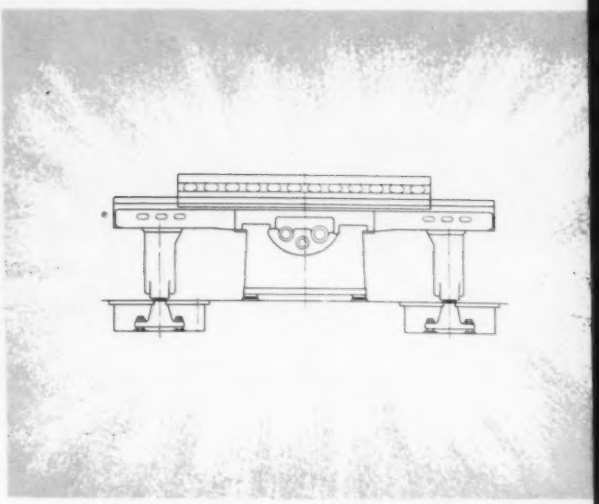
Machine handles equally well both stub and line boring operations. G&L enclosed end support maintains long boring bars with heavy tools in accurate alignment. Movements of end support bearing block and headstock are perfectly synchronized, with identical ground lead screws.

Highlighting G&L machine rigidity is 4-point, full-length headstock gibbing and self-equalizing clamps. This design creates maximum rigidity for travel and positioning anywhere on heavy, square column ways.

Further 30 Series table-type Horizontal machine specifications are offered in Catalog No. 30-T. Get your copy from your nearest G&L representative or write direct.

G&L attachments and accessories that extend machining possibilities and profits

The world's broadest line increases scope of operations for 30 Series table-type Horizontals. It includes: plain, hand or power feed rotary tables; continuous feed facing head; angular milling attachments; and a complete line of Davis tools, arbors and sleeves. *Optional arrangements:* automatic electric positioning and improved measuring devices, pick-off gears for thread leads, built-in precision lead device and Dupli-Tracer electronic contour and profiling system.



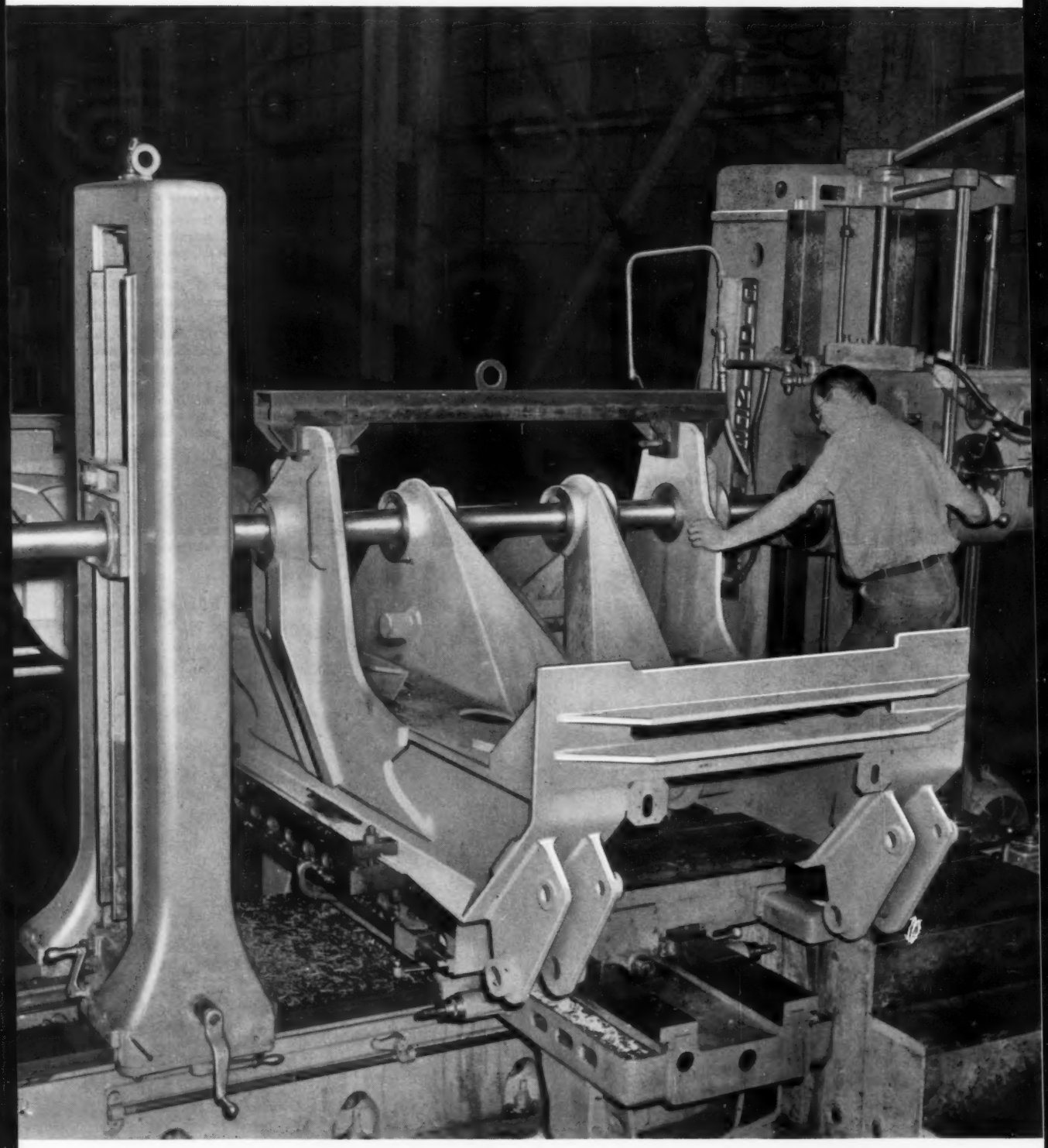
Exclusive G&L extended saddle and saddle supports (optional) — for precision machining of large workpieces. Diagram illustrates how table and saddle are *fully supported* even at their extreme positions. Used where greatest accuracy is required in progressive machining on different parts of workpiece.

The 30 Series line of Horizontals include the Model 350-T with 5" dia. spindle (25 hp) and Model 340-T with 4" dia. spindle (20 hp.) Both machines offer a broad choice of headstock, table and saddle travel. Other horizontal boring machines are offered in spindle diameters ranging from 3" to 14" . . . main motor drive 10-150 hp.

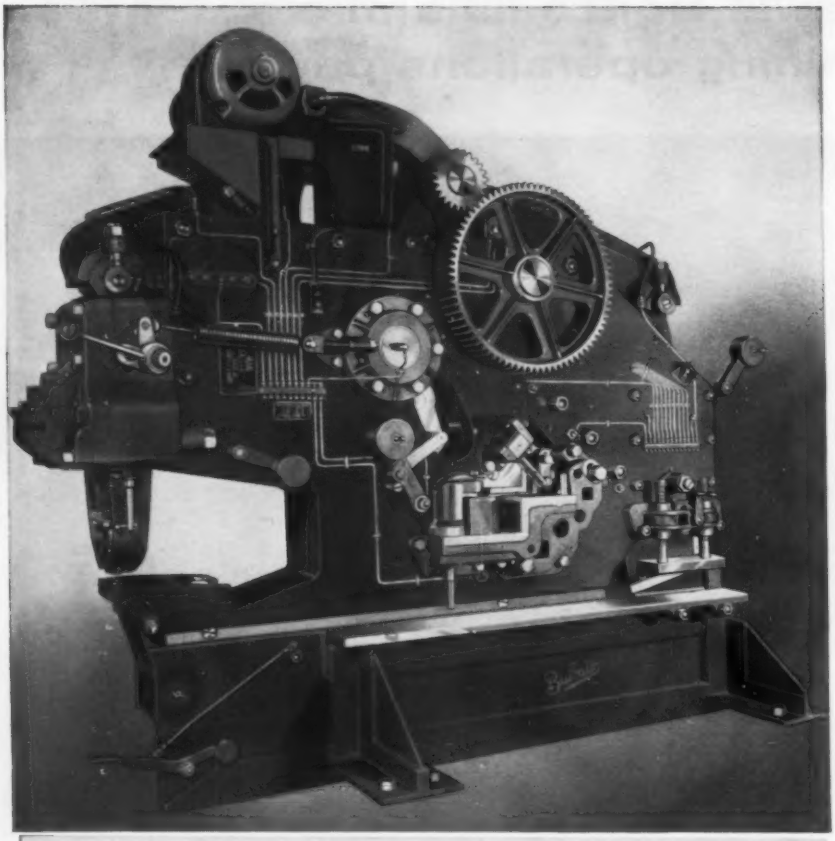
G & L *and* HYPRO DIVISION
GIDDINGS & LEWIS MACHINE TOOL CO.
FOND DU LAC, WISCONSIN G-86

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; HYPRO Double Housing and Openside Planers; Planer-Type Milling Machines; Vertical Boring Mills; Spar and Skin Milling Machines and VARIAX Profile Milling Machines.

Giddings & Lewis Horizontals make multiple machining operations pay off



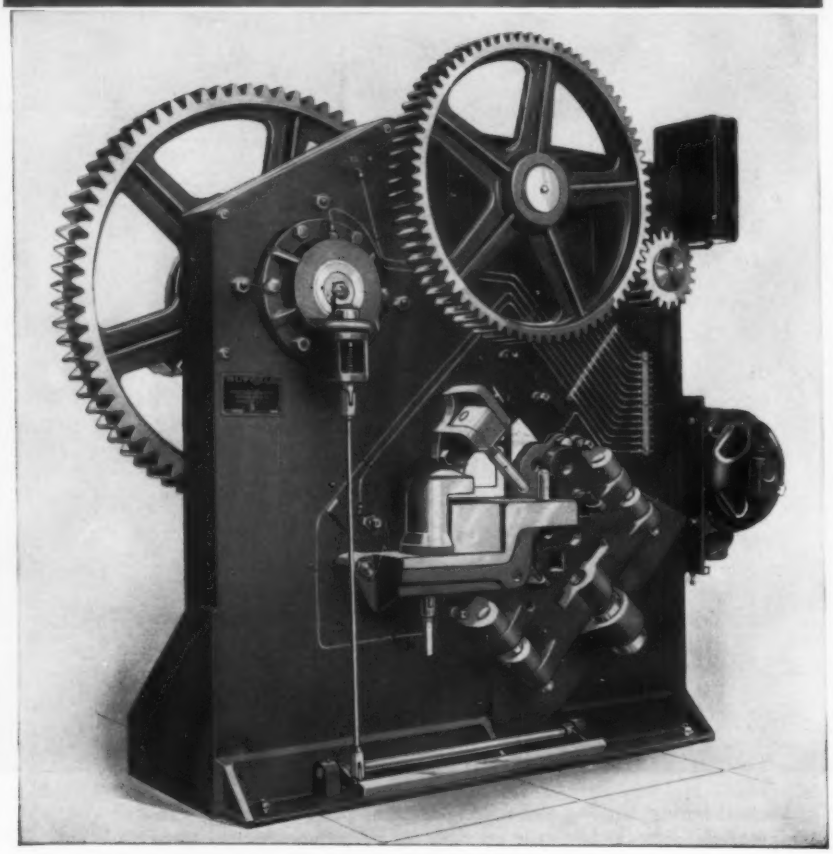
This 30 Series table-type Horizontal boring, drilling and milling machine performs rough, semi-finish and finish-precision boring of rear-axle, tandem-drive assembly for an earthmover component.



DO

"BUFFALO" IRON WORKERS

These powerful, multi-purpose Universal Diagonal machines shown at upper left punch flanges and webs of I-Beams, channels, girders, Bethlehem Beams and H-sections. They notch angles, tees, beams, channels and plates — shear plates, flats and angles — cut rounds, squares, angles at 45° and 90°, and tees. They have the versatility of the popular Universal Iron Workers, plus large capacity — for example, the No. 4½ U.D. Machine shown, has $1\frac{9}{16}$" x $1\frac{1}{4}$" or $1\frac{3}{8}$" x $1\frac{3}{8}$" punch capacity and will shear $1\frac{1}{4}$" plates thru center. It's built up to the job, too, with its welded steel plate box frame, heavy shafts, bearings, bolsters and plungers, plus centralized oiling system. Write for Bulletin 360-G for full capacities and details.



"BUFFALO" DIAGONAL BAR CUTTERS

— like this No. 9 model at left, are easy to set up, fast-cutting and trouble-free. Large knife openings permit wide flexibility of knife combinations for minimum tool changing. 6 sizes, to handle rounds, squares, angles, tees, flats, beams or channels at speeds between 18 and 30 strokes per minute. Largest size cuts 4½" rounds or 4" squares. Also available in diagonal and special models. Write for Bulletin 3295-C, which also describes "Buffalo" Billet Shears.

COLD BENDING AT PROFITABLE SPEED

Heavy industry uses "Buffalo" Bending Rolls like this big No. 2 Horizontal model illustrated on facing page to produce arcs, circles and spirals from heavy sections at profitable speeds. No tooling is required — rolls are quickly changed and adjusted to handle angles, tees, beams, channels, flats, tubes and pipes at the desired radius. All work is bent cold, and commercially accurate curves are easily obtained. Write for Bulletin 352-C.

MORE BIG JOBS EASIER WITH "BUFFALO" MACHINES!

• CUTTING • SHEARING • BENDING • PUNCHING • SLITTING • NOTCHING

"Buffalo" machines have long been the choice of industries doing heavy structural fabrication — from bridge firms to manufacturers of large machinery. Each of these machines is engineered with the power, rigidity and convenience of operation to turn out the work accurately at profitable speeds. And you have a wide selection — Billet Shears, Bar Cutters, Bending Rolls, Wrapping Rolls, Iron Workers, Mill Type Shears and many others. All are built to the "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life. Write us for recommendations on *your* fabrication problem!

LARGE-DIAMETER ANGLE BENDING

like the above is routine with "Buffalo" Bending Rolls; one tank fabricator forms rings up to 104-ft. in diameter, to fractional-inch tolerances.

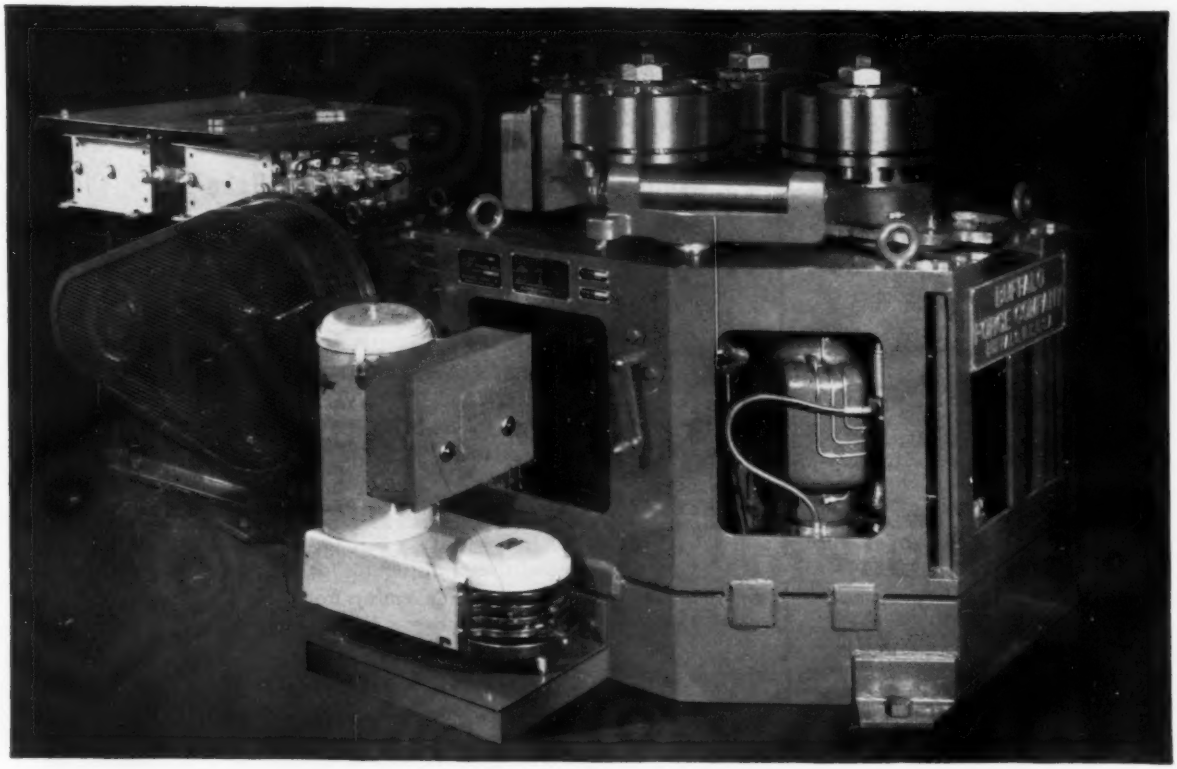
ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

BUFFALO FORGE COMPANY

440 BROADWAY BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING • PUNCHING • SHEARING • BENDING

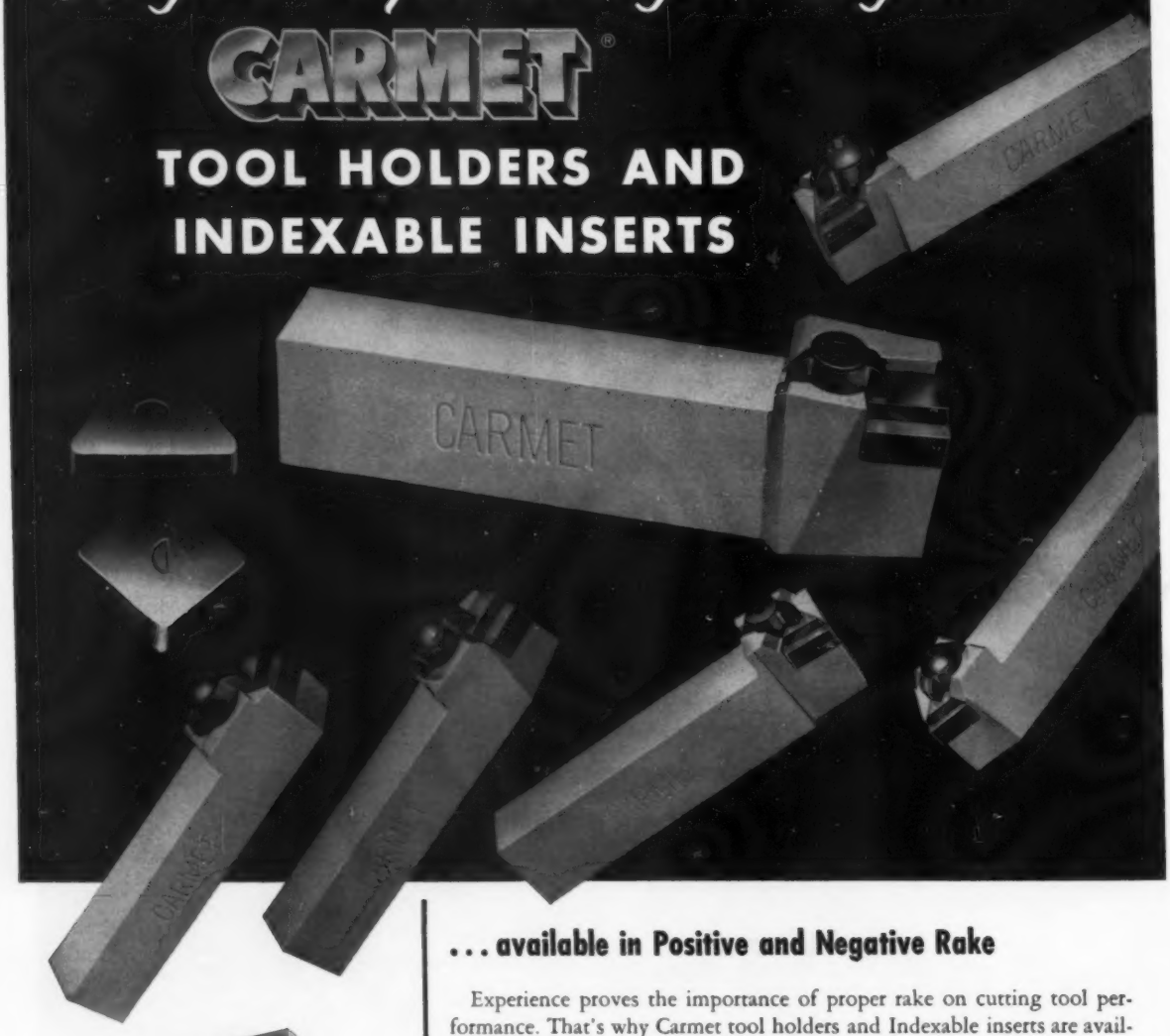


For more information fill in page number on Inquiry Card, on page 227

Designed for your Cutting Tool Program...

CARMET®

TOOL HOLDERS AND INDEXABLE INSERTS



Write for this NEW CATALOG:
CARMET TOOL HOLDERS and INDEXABLE INSERTS

Expanded to 16 pages, this latest edition contains specifications of Carmet tool holders and Indexable inserts, replacement parts for tool holders, and information on choosing the proper carbide grade for the job.

WSW 6859 **ADDRESS DEPT. M-1**

. . . available in Positive and Negative Rake

Experience proves the importance of proper rake on cutting tool performance. That's why Carmet tool holders and Indexable inserts are available in *both* positive rake (for light cutting on easy-to-machine materials) and negative rake (for heavy cutting on high tensile materials).

CHECK THESE FEATURES

- **Up to eight cutting edges on each carbide insert.**
- **Grinding is eliminated—no special reconditioning equipment needed.**
- **Each insert is permanently marked for easy grade identification.**
- **Tool holders cadmium plated to resist corrosion and chip erosion.**
- **Tool holder design permits quick, accurate indexing of inserts to new cutting edge.**
- **Inserts cost but a few pennies per each new cutting edge.**

Ask your A-L representative or distributor for engineering assistance in choosing the right tool for your requirements from Carmet's complete line.
Allegheny Ludlum Steel Corporation, Carmet Division, Detroit 20, Michigan.

For all your **CARBIDE** needs, call

ALLEGHENY LUDLUM

Branch offices and distributors in all principal cities

ACHESON COLLOIDS COMPANY 50TH ANNIVERSARY 1908 1958

Golden year for... BLACK MAGIC

ACHESON FIFTY YEARS OF FINE DISPERSIONS

In our 50 years of manufacturing dispersions of colloidal graphite, we've seen the unique anti-friction properties of this basic material make lubricating problems disappear as if by "black magic". As an additive to lubricating oils and greases, as a parting agent in many kinds of casting and as a dry-film lubricant in diverse fields of metal working . . . in application after application . . . it has proved literally more valuable than gold.

Dr. Edward Goodrich Acheson's invention of colloidal graphite over 50 years ago has been followed by a constantly expanding program of fundamental research and product development. Today, with over 50 different dispersions already in use, three laboratory groups at Acheson are pressing toward perfection of whole new families of dispersions and their applications.

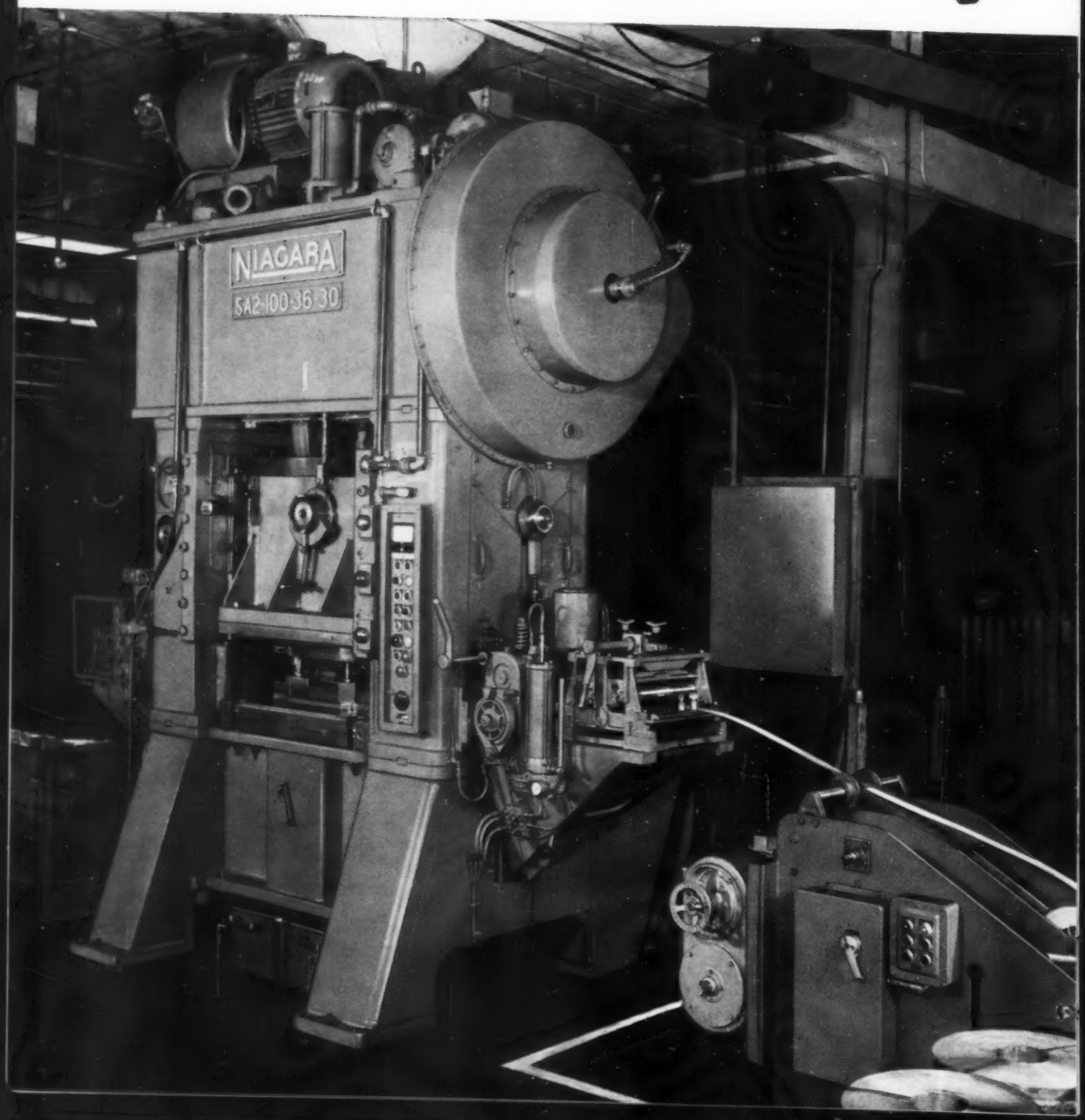
The custom dispersing of solids requires specialized facilities and production techniques. Why not take advantage of Acheson's 50 years of leadership in this field?

You will be interested in the number of different dispersed solids, in addition to graphite, that are being used successfully today in industry. Our Products List gives you, in quick-reading chart form, a résumé of Acheson 'dag'® brand dispersions and their typical applications. Send for your copy. Address Department M-18.

ACHESON *Colloids Company*
PORT HURON, MICHIGAN
A division of Acheson Industries, Inc.
Also Acheson Industries (Europe) Ltd. and affiliates, London, England

Offices in:
Boston • Chicago • Cleveland • Dayton • Detroit • Los Angeles • Milwaukee
New York • Philadelphia • Pittsburgh • Rochester • St. Louis • Toronto

Ready for you... ALL-NEW



AUTOMATIC PRESS

to give you more stampings per hour at less cost... in long and short runs

Build your stamping profits to new heights the modern way: Automatically . . . with an all-new Niagara SA-2. Here's an up-to-the-minute press package that is distinctly different from anything heretofore available . . . complete with ultra-modern automatic feed, plus today's most advanced press mounted controls and devices, to bring you high speed stamping at its very best.

Brand new from crown to base, the Niagara Automatic boasts bonus features throughout . . . features that are unavailable on any other press in this category. Yes, *everything* is new about it, differing sharply from modified, adapted straight side presses of conventional design. Every square inch of its extra massive, rugged construction is *heavier . . . far heavier* for vibration-free, precision performance at high speeds:

KING SIZE CRANKSHAFT AND CRANKPINS — substantially larger than those on traditional straight side presses.

ENTIRE DRIVE IS HEAVIER — gears, electro pneumatic friction clutch, brake, flywheel and motor.

EXTRA BEARINGS — for better support of crankshaft, feed take-off and main gear (or flywheel).

MASSIVE, EXTRA HEAVY FRAME — all steel, 4-piece, tie rod, box type construction (bed, uprights and crown) built to absorb shock and vibration, and provide greater resistance to deflection. Up to 100% heavier than regular straight side press construction. Uprights extra wide to house electrical and circulating oil controls.

RIGID, EXTRA REINFORCED, BOX TYPE SLIDE remains in precise alignment with bed.

EXTRA LONG, SPECIAL SQUARE GIBS guide slide precisely.

LAMINATED, NON-METALLIC WAYS positively prevent welding or galling of bearing surfaces.

AUTOMATIC CIRCULATING OIL SYSTEM keeps all press bearing surfaces continuously lubricated.

ULTRA-MODERN AUTOMATIC FEED perfectly mated to press.

EXCLUSIVE NIAGARA MECHANICAL ROLL LIFTING SYSTEM — built into the press for independent, infinite adjustment of ingoing — outgoing rolls, from floor level.

OVERSIZE ADJUSTABLE AIR COUNTERBALANCE for smoother, safer press performance.

From start to finish, automatic stamping the Niagara SA-2 way, spells endless economies for you. It will pay you to investigate the facts *now*.

THE FULL STORY is unfolded for you, feature by feature, in new, illustrated Bulletin 264. Write for your copy today . . . then consult a Niagara representative.

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N. Y.

DISTRICT OFFICES: Boston • Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

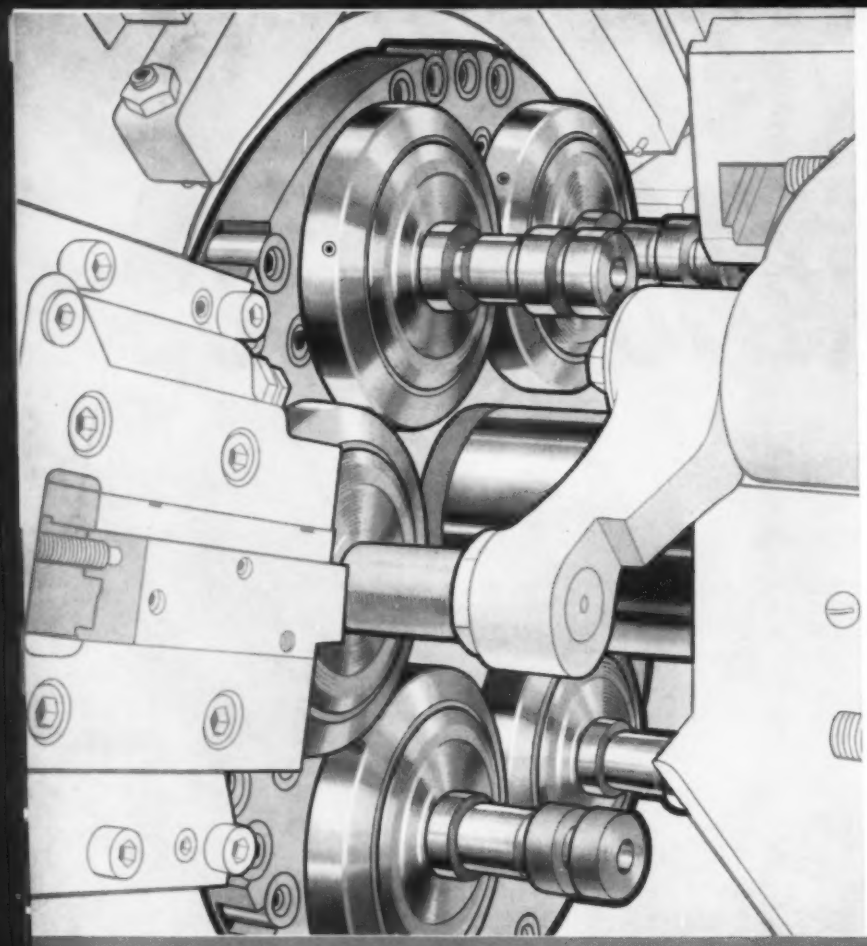
Distributors in principal U. S. cities and major foreign countries

NIAGARA

SERIES SA-2, TWO-POINT STRAIGHT SIDE PRESSES

SHAFT DIAMETERS: 4½-9 INCHES • CAPACITIES: 60-300 TONS

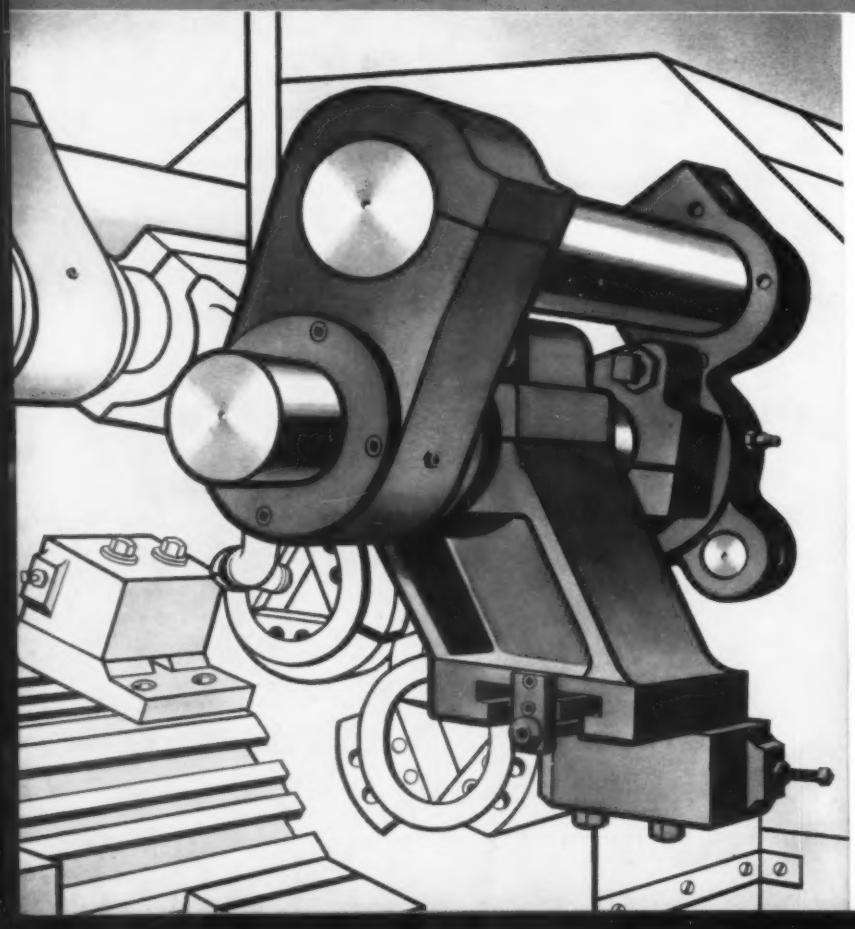
America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work



Look at New Britain's

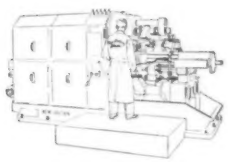
new automatic bar machines

The widest range of spindle speeds among machines of comparable capacity and accuracy.



Look at New Britain's

exclusive chucker arms

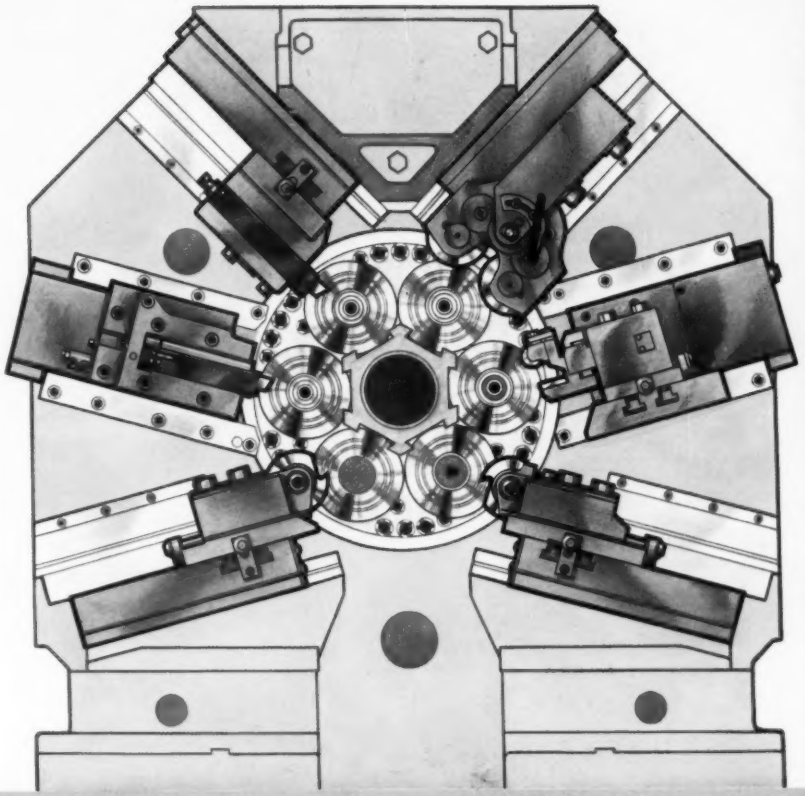


All the ruggedness of a cross slide, but with two-way motion for cutting O.D.'s, I.D.'s, tapers and radii and for recess boring, in addition to facing cuts. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

Look at New Britain's

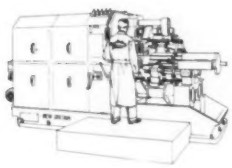
new cross slide arrangement

Independent radial cross slides in *all* positions, providing maximum clearance for more cross slide operations.

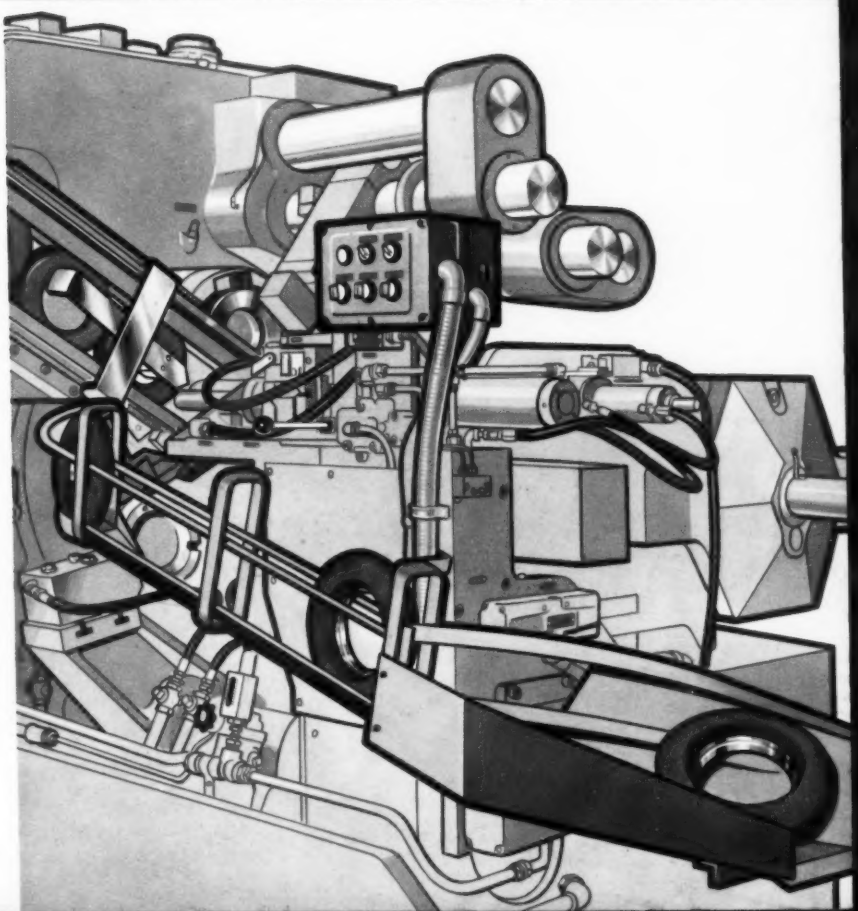


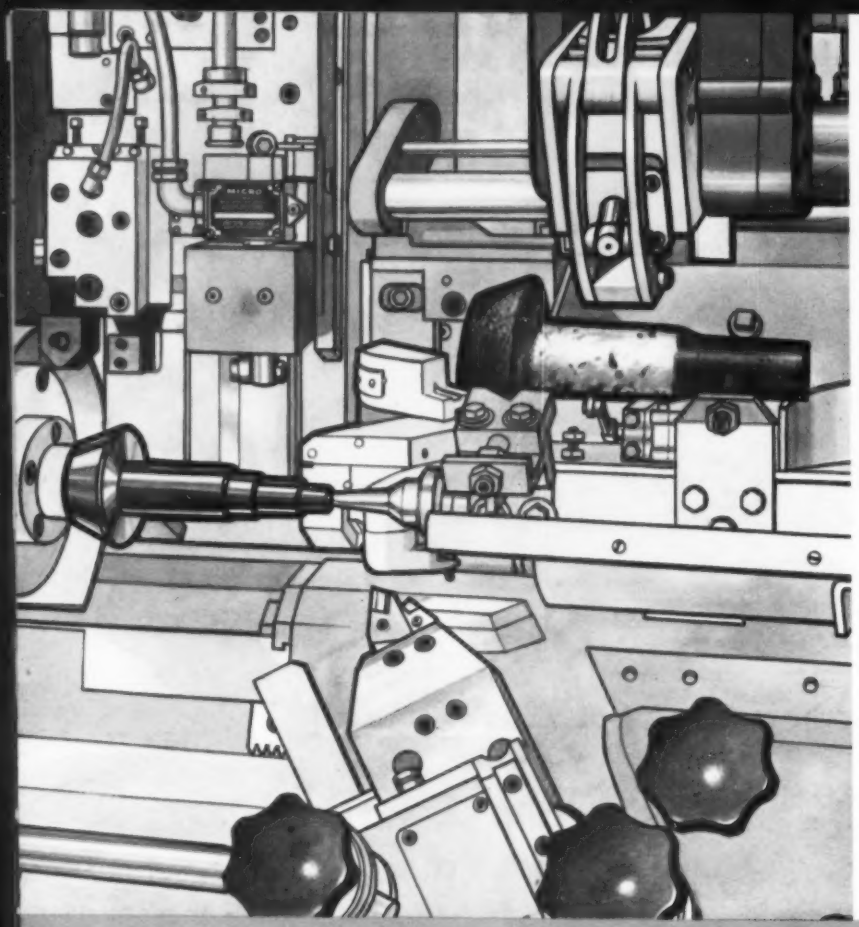
Look at New Britain's

open-end chucker design



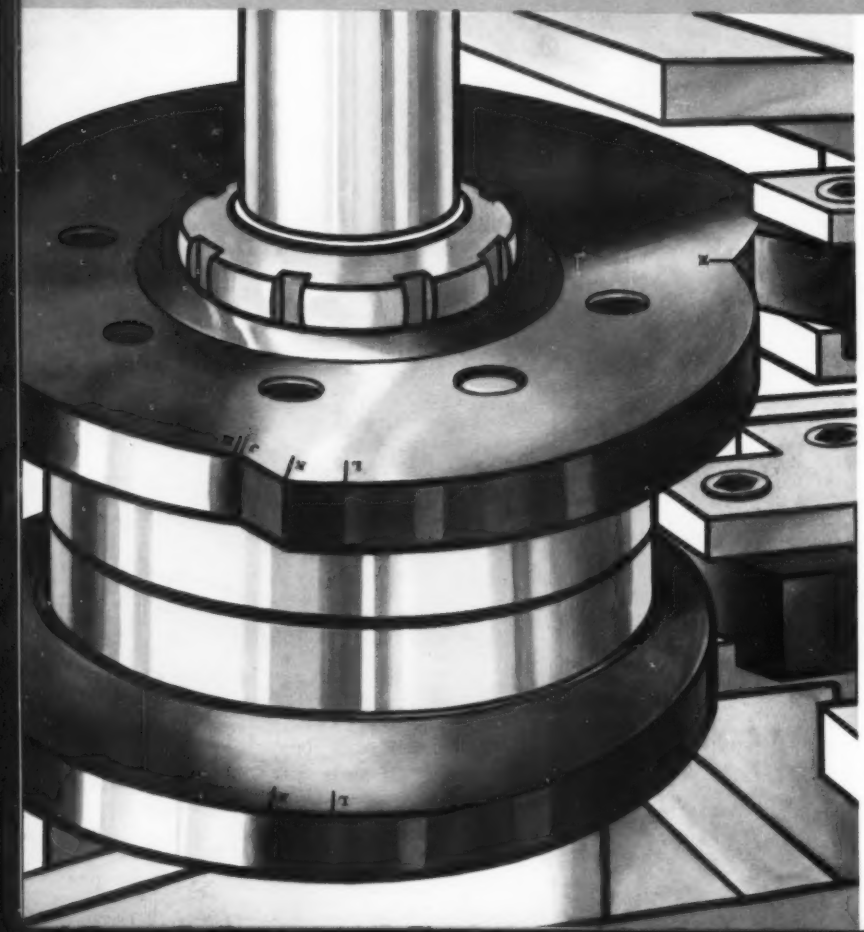
Greater accessibility for all applications and particularly well adapted to automatic handling of pieces. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.





Look at
Automatic Loading on
New Britain +GF+

This basic optional feature can make money for you whether you are working with forgings, bar slugs, or bar stock.

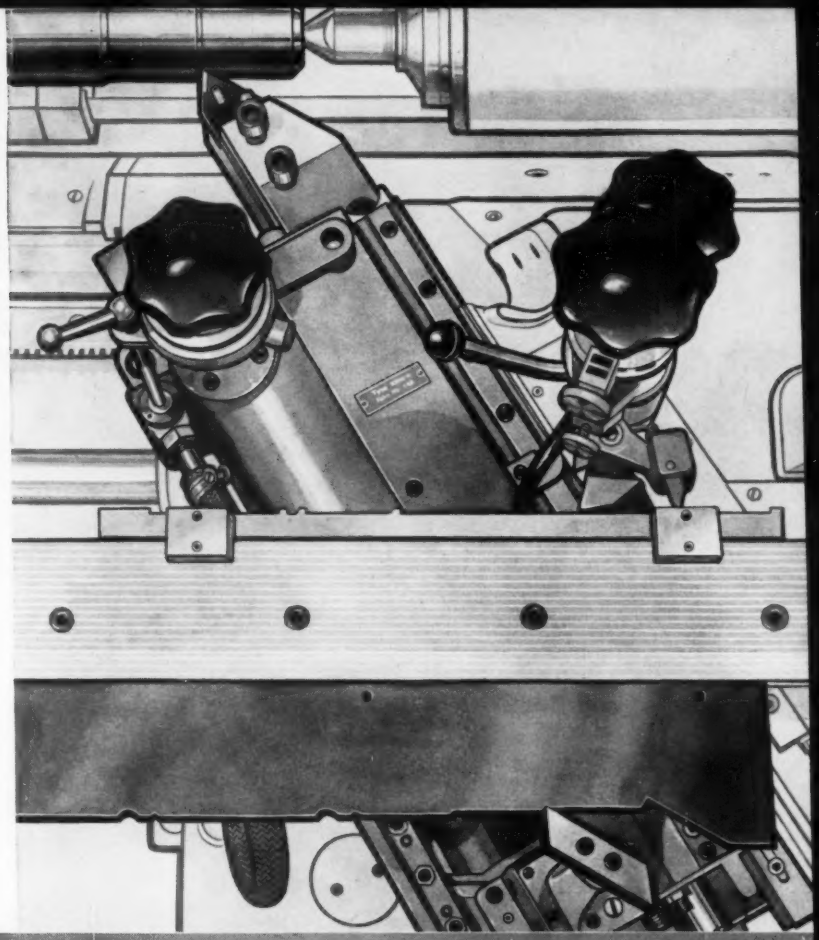


Look at New Britain's
cam-controlled boring machine

When you are working to tenths there is no substitute for the positive tool control that only precision cams provide. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

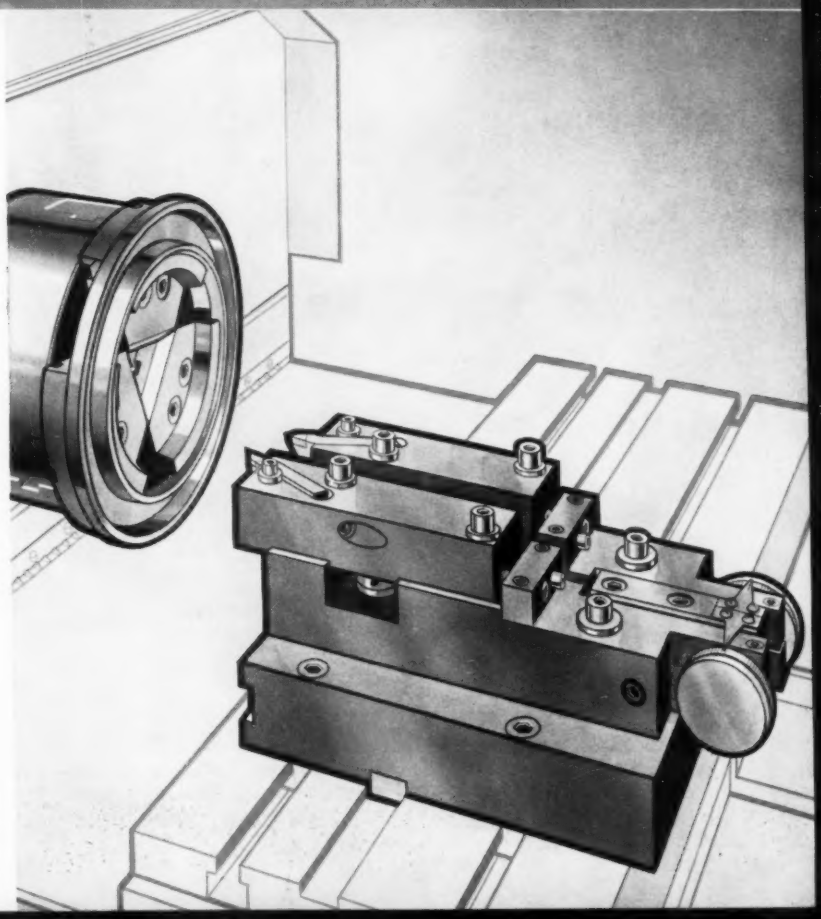
Look at
Single Point Tooling on
New Britain +GF+

Outproduces gang tooling setups by reducing tool change time practically to zero, and by cutting at maximum speeds and feeds for tool efficiency.

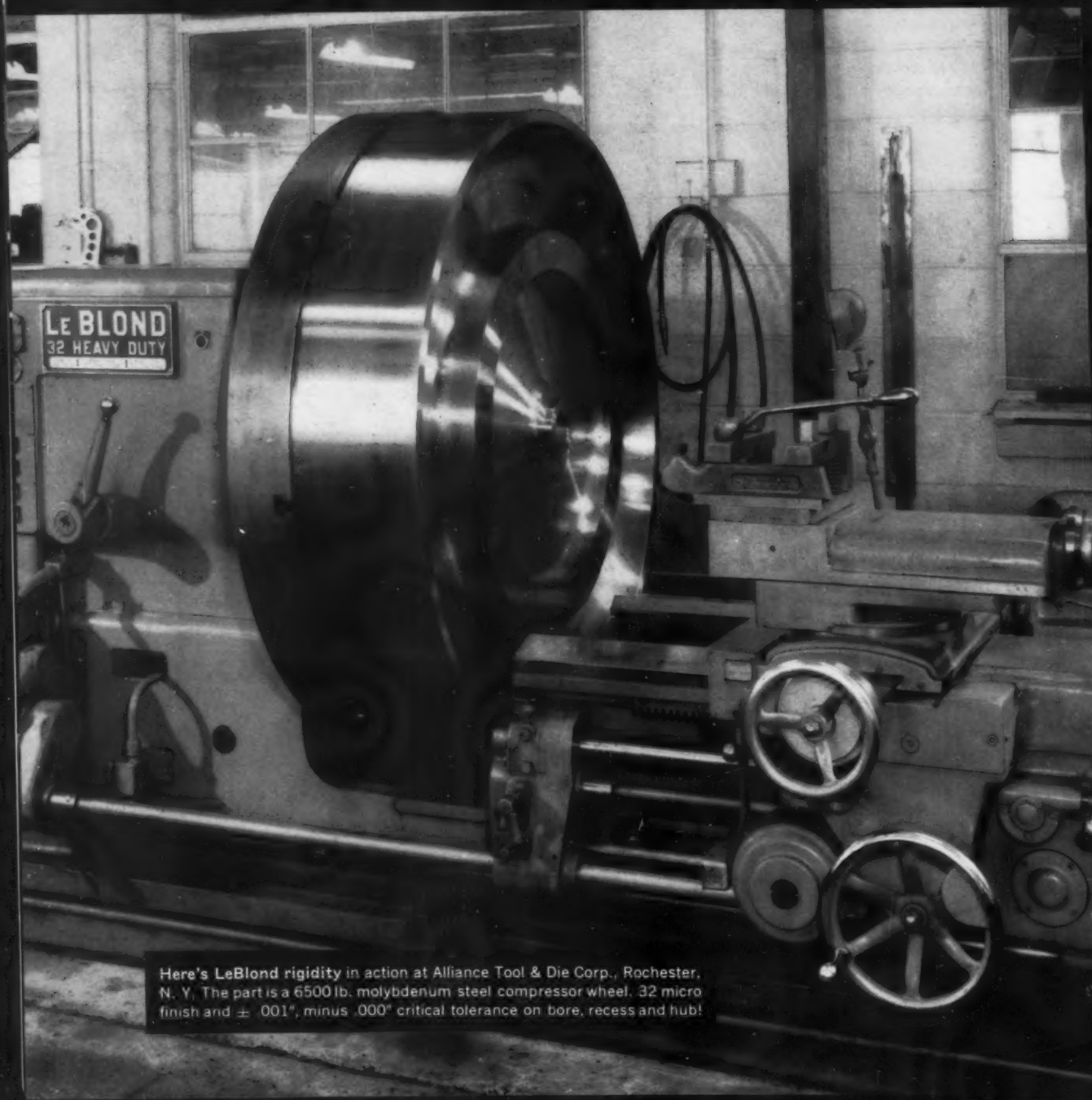


Look at New Britain's
simple approach to problem pieces

Low cost per piece is inherent in New Britain Precision Boring Machines because of their simplicity, versatility, speed, repetitive accuracy and inexpensive tooling. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.



What is the BIGGEST



Here's LeBlond rigidity in action at Alliance Tool & Die Corp., Rochester, N. Y. The part is a 6500 lb. molybdenum steel compressor wheel. 32 micro finish and ± .001", minus .000" critical tolerance on bore, recess and hub!

workpiece your lathes can turn?

Probably your lathes will swing a 32″ piece. Or 40″. But what happens when that occasional 50″ or 60″ job comes along? Chances are you have to say, "We can't handle it. After all, how can you justify a big swing lathe, just for a few big jobs a year?"

Today there *is* a practical and economical solution to this odd-size work problem. LeBlond Sliding Bed Gap Lathes.

Our 32″/60″ Heavy Duty will accommodate work up to 60″ diameter! Basically this is a 32″ lathe. But it has an extendible bed (an upper bed that slides on a lower bed). Slide it to the right, and a gap opens. Now, you have a full 60″ swing! Also, for extra long work, there is 50% greater center distance. And the rest of the time you have a regular 32″ heavy duty lathe for a wide variety of work.

3 lathes in one—at the cost of a lathe and a half!

Here's an example of how this extra capacity pays off. Alliance Tool and Die Corp., Rochester, N. Y. are specialists in unusual machining problems, like precision molds—and the bulky compressor wheel, shown here. How did they turn it before? They didn't. The part was too big. Now, with their 32″/60″ LeBlond (recommended by Macaulay Machinery Co., Rochester, N. Y.,) they take jobs like this right in stride. Actually, this particular order was made possible by this lathe.

If you do job shop work, you can consider this lathe a business-getter. If you're doing your own maintenance, it gives you the capacity to do virtually all your own turning work. LeBlond Sliding Bed Gap Lathes are available in 4 sizes—16″/38″, 25″/50″ and 32″/60″ (shown) Heavy Duties and the 17″/28″ Regal. You're sure of getting the right lathe for your job when you buy LeBlond. There are 76 lathe models to choose from. Call your LeBlond Distributor or write.

Here's how the LeBlond Sliding Bed Gap Lathe gives you extra capacity for extra large work:

BED GAP CLOSED—*functions as a regular 32″ lathe.*

BED GAP OPEN—*full 60″ swing.*

BED FULLY EXTENDED—*50% greater center distance.*

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LeBLOND *of Cincinnati*

World's Largest Builder of a Complete Line of Lathes for More than 71 Years

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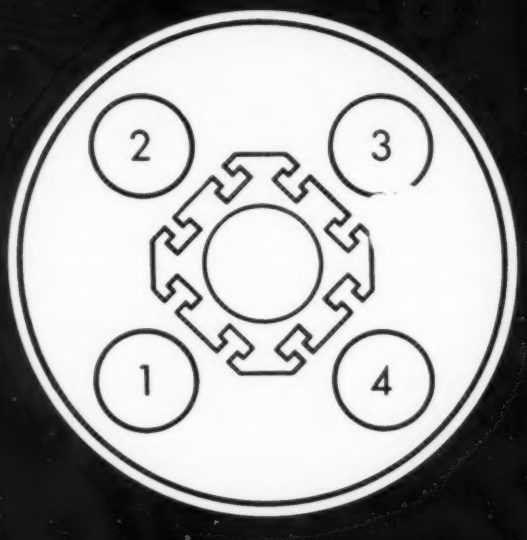
a message to production-minded engineers with automated equipment in mind



These multiple-spindle diagrams are symbols of one of the earliest, simplest, and yet most efficient forms of automation the world has yet known. They represent circumferential automation, a design principle embodied in the development of the first automatic screw machine, built in 1893 by National Acme and inherent in all Acme-Gridleys since then.

don't overlook the advantages of

circumferential automation *

* Think of each spindle on an Acme-Gridley multiple-spindle automatic as a work station, and you will quickly see that here, too, is automation . . . *circumferential* automation. Here, as in all forms of automation, pre-sequenced operations are *performed in succession—and without manual attention*—to save time and cut costs in many ways.

Actually, circumferential automation goes all other forms one step better; rather than requiring a line of machines and transfer arrangements, Acme-Gridley's speedy, compact spindle arrangement *saves floor space, machine investment and man hours.*

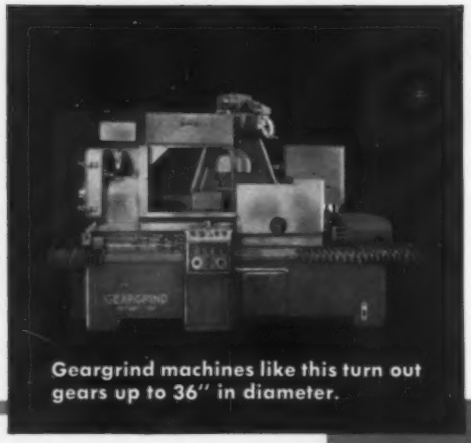
Admittedly, multiple spindle operation is not the answer to all machining problems. Today however, production men are taking a closer look to be sure they are missing no bets. They cannot afford to be wrong tomorrow.

Is there a place for *circumferential* automation in *your* operation? Let us help you find out.

National Acme

THE NATIONAL ACME COMPANY, 179 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

builders of the world's only complete line of multiple-spindle, bar and chucking automatics



Geargrind machines like this turn out gears up to 36" in diameter.

4-WAY *Versatility*

TO FINISH GRIND GEARS, SPLINES AND SPECIAL CONTOUR PARTS TO YOUR REQUIRED TOLERANCES

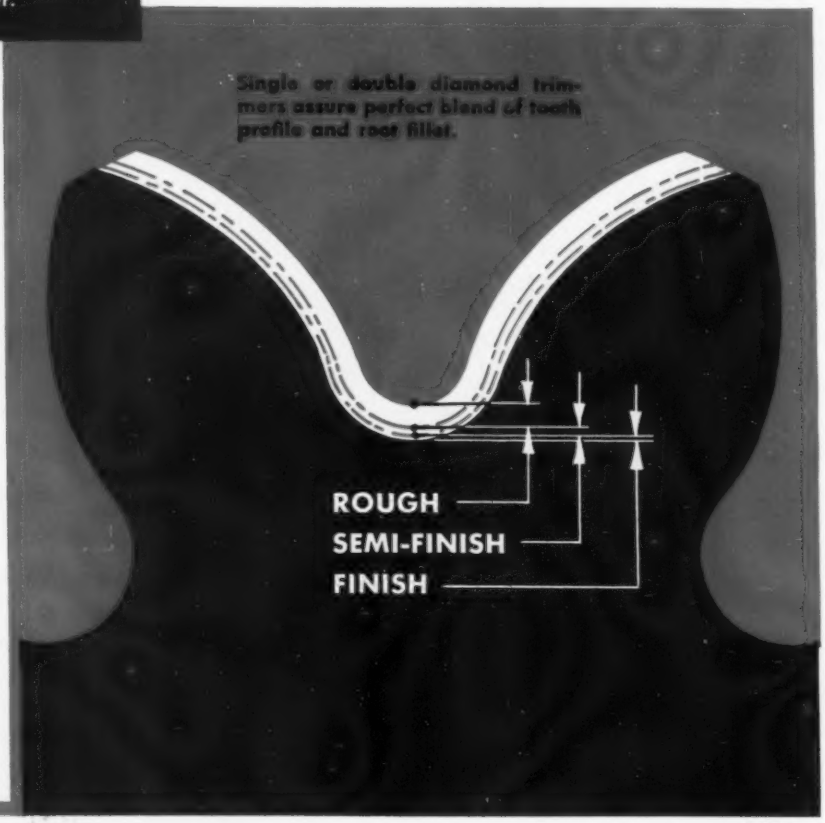
1
ROUGHING GRIND

2
ROUGH GRIND
FINISH GRIND

3
ROUGH GRIND
SEMI-FINISH GRIND
FINISH GRIND

4
MANUAL GRIND

Choose from any of the above four methods (with selective feed increments) depending on your requirements.



57MT-A

Besides the exceptional versatility illustrated above, Geargrind machines deliver high productivity and accuracy. Over 10 years ago, design engineers at Geargrind tackled the job of building a machine to grind gear teeth to the finest quality at the highest possible production rate. Finished product of this effort is today's Geargrind machine. Geargrind machines now offer outstanding performance in all types of aircraft, automotive and industrial applications.

ALL GEARGRIND MACHINES:

- Perform operations never before possible
- Save valuable time
- Decrease the need for skilled operators
- Increase production rates
- Offer unmatched combination of features

WRITE FOR LITERATURE

The entire Geargrind story is covered in this illustrated brochure. Send today for your free copy.

GEARGRIND Detroit

THE GEAR GRINDING MACHINE COMPANY

3921 Christopher, Detroit 11, Michigan

MANUFACTURERS OF: THE DETROIT SCREWMATIC 750, AUTOMATIC SCREW MACHINE RZEPPA ("SHEPPA") CONSTANT VELOCITY UNIVERSAL JOINTS

Why the Leader gives you more!

Because of his laboratories and know-how the leader can give you better design. The leader can afford more efficient tooling and greater quality control.

The leader can give you a better cylinder without a premium price.

The leader in air and hydraulic cylinders is Hannifin.

AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS

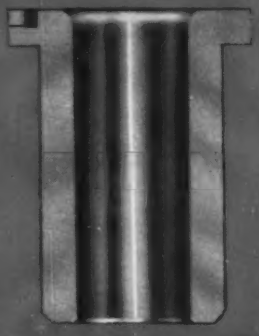
Write for your copy of this new Hannifin Cylinder File—complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Hannifin Company, 509 South Wolf Road, Des Plaines, Illinois.

you get close tolerance drilling with

UNIVERSAL DRILL BUSHINGS

Accurately machined bushings are essential when drilling to close tolerance. **UNIVERSAL DRILL BUSHINGS**, of finest quality steel, are carefully tested for 100% concentricity and hardness, assuring pin-point accuracy and uniform quality. To prevent tool hang-up and breakage, each bushing has a blended radius on the top inside diameter.

All bores are superfinished. This superfinishing of bushings is important, especially in close tolerance work, because it reduces both tool and bushing wear to a minimum. Knurled head gives a quick, sure grip.



We stock drill bushings in all standard sizes and lengths at each of the following offices—Universal Engineering Sales Co., 1060 Broad St., Newark 2, New Jersey; 5035 Sixth Ave., Kenosha, Wis., and at our home office in Frankenmuth. Contact the nearest office for immediate delivery.

The Universal Drill Bushing Slide Chart gives accurate engineering data for the selection of all types and sizes of drill jig bushings up to 1¾" drill size. You may have one—free—by requesting on your company letterhead. At the same time, get your copy of our new catalog that describes all of UNIVERSAL'S products including chucks, tool holders, boring bars, bushings and index plungers.

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 2, MICHIGAN

207

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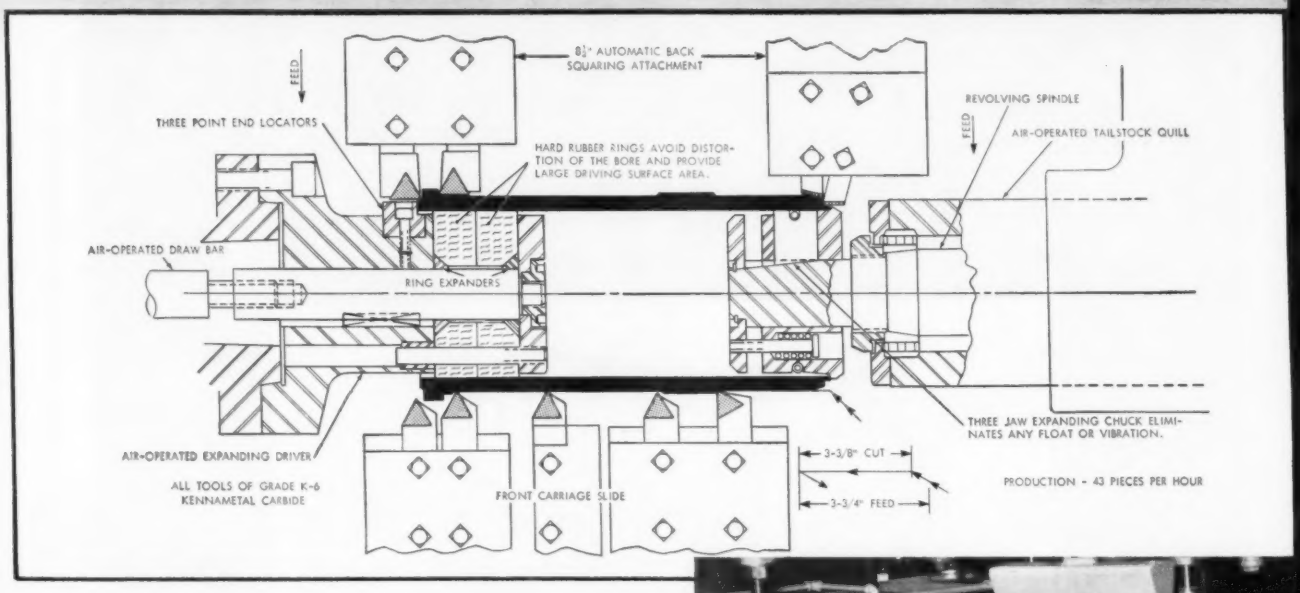
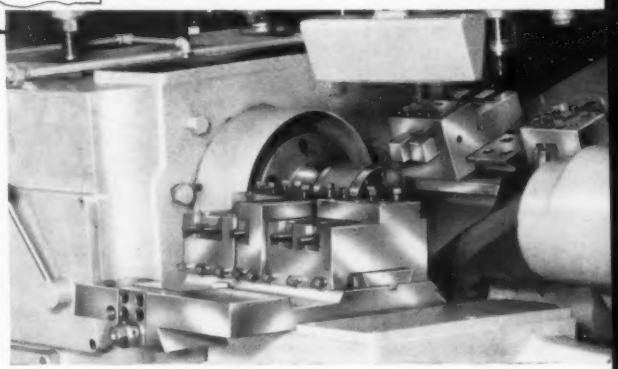
CYLINDER LINERS MACHINED ECONOMICALLY ON Lo-swing LATHES


FEED
8½" AUTOMATIC BACK SQUARING ATTACHMENT
THREE POINT END LOCATORS
HARD RUBBER RINGS AVOID DISTORTION OF THE BORE AND PROVIDE LARGE DRIVING SURFACE AREA.
REVOLVING SPINDLE
FEED
AIR-OPERATED TAILSTOCK QUILL
AIR-OPERATED DRAW BAR
RING EXPANDERS
THREE JAW EXPANDING CHUCK ELIMINATES ANY FLOAT OR VIBRATION.
AIR-OPERATED EXPANDING DRIVER
ALL TOOLS OF GRADE K-6 KENNAMETAL CARBIDE
FRONT CARRIAGE SLIDE
3-3/8" CUT
3-3/4" FEED
PRODUCTION - 43 PIECES PER HOUR

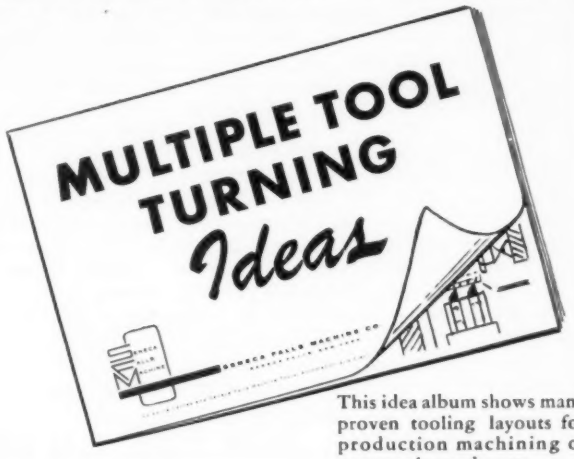


PROBLEM: To turn... without distortion... as well as face and chamfer, various cast, thin wall Diesel Cylinder Liners.

SOLUTION: The Model AR Automatic Lo-swing Lathe was selected for this job as it has: (1) *Necessary rigidity* for utilizing carbide tools. (2) *Simplified Change-Over Mechanism,* permitting all cams to be pre-set to graduated dials for length of cut. (3) *Instantaneous Tool Relief Control Mechanism,* which permits reversing carriage and slide feed movements without disturbing timing of slides or adjustment of the tools.

The Cylinder Liners are driven on the headstock end with a special driver which permits high cutting speeds and coarse carriage feeds without distortion. The tailstock end of the liner is supported with an expanding chuck operating under controlled air pressure to prevent distortion. All turning, facing and chamfering operations are performed simultaneously. The entire cycle is automatic; the operator simply loads and unloads the parts and pushes the starting button.

PRODUCTION!!! 43 pieces per hour at 100% efficiency. Seneca Falls engineers find solutions for the most difficult turning problems and are at your service.



This idea album shows many proven tooling layouts for production machining of commonly used parts.

SENECA FALLS MACHINE
ENGINEERED FOR PROFIT

MAIL THIS COUPON

OR WRITE ON YOUR LETTERHEAD FOR

Your Free Copy

SENECA FALLS MACHINE CO.

SENECA FALLS, NEW YORK

Lo-swing Lathes and Seneca Falls Machine Tools, Automation and Electronics

Send a free copy of "Multiple Tool Turning Ideas" to:

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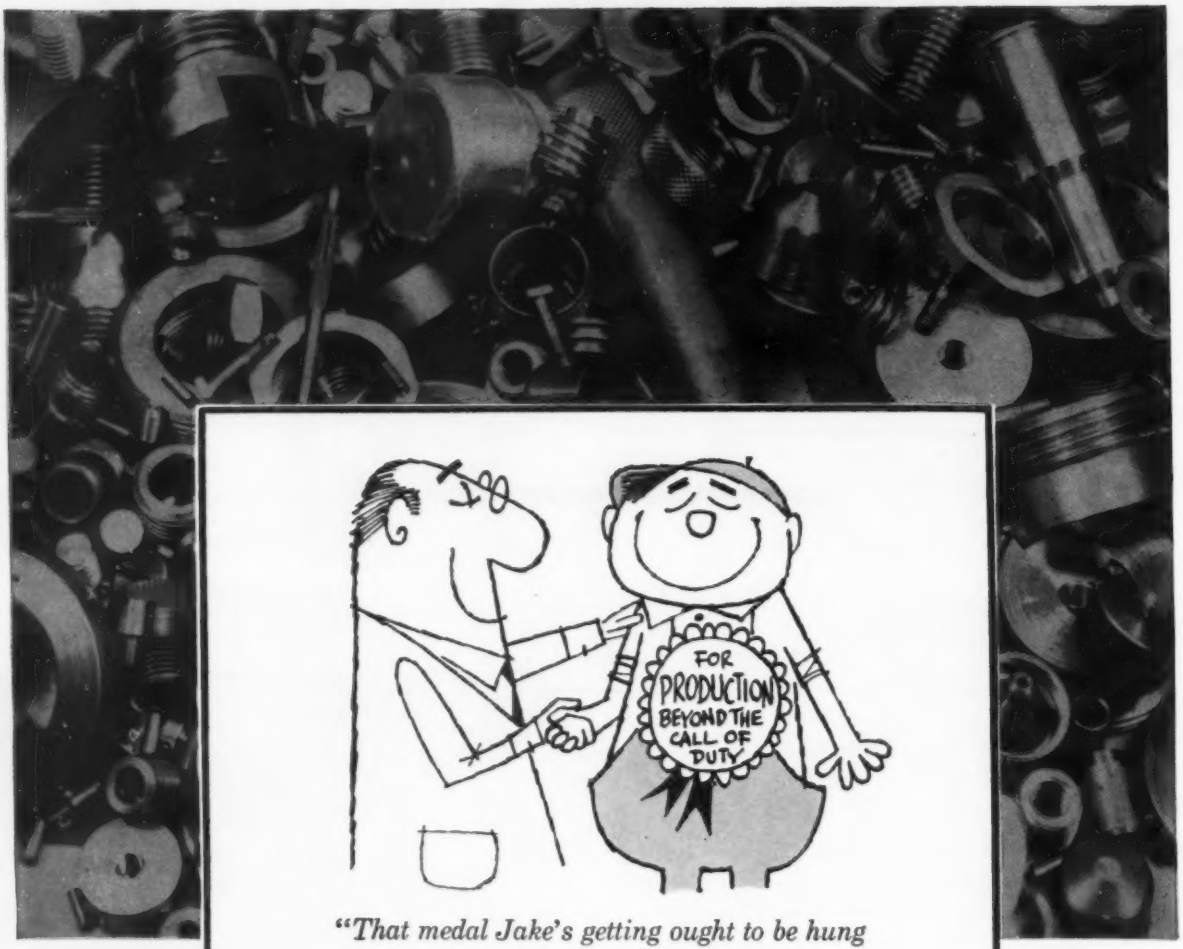

"That medal Jake's getting ought to be hung on our stock of MX"

To hang up production records takes more than modern equipment and experienced operators. You've got to use screw stock that makes it possible for both to perform at top efficiency.

That's why so many shops have switched to USS Free-Machining MX Steel. With this faster-cutting screw stock, production increases of 50% or more are not unusual . . . tool life is extended, frequently doubled, and down-time is correspondingly reduced.

What's more, with MX on the job, screw machine parts are not only turned out in record time but, because MX is consistently uniform in cutting characteristics and in freedom from injurious imperfections, parts made with MX are *better* parts—better in finish, accurate in dimension and with fewer rejects to cut into profits.

USS Free-Machining MX Steel has been successfully machined at speeds up to 350 SFM—yet it costs no more than regular screw stock.

Based on results obtained in producing more than a billion parts of many different kinds and under widely different conditions, we feel sure that *MX will cut the cost of any part* you now machine from regular screw stock grades. Why not prove it for yourself?

Available both in Bessemer and Open Hearth grades, USS Free-Machining MX is produced in all the popular screw stock sizes. It is sold in cold-finished form by your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest district office.

UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

More parts... better parts... at lower cost per part

—when you do the job with free-machining

MX

USS

UNITED STATES STEEL

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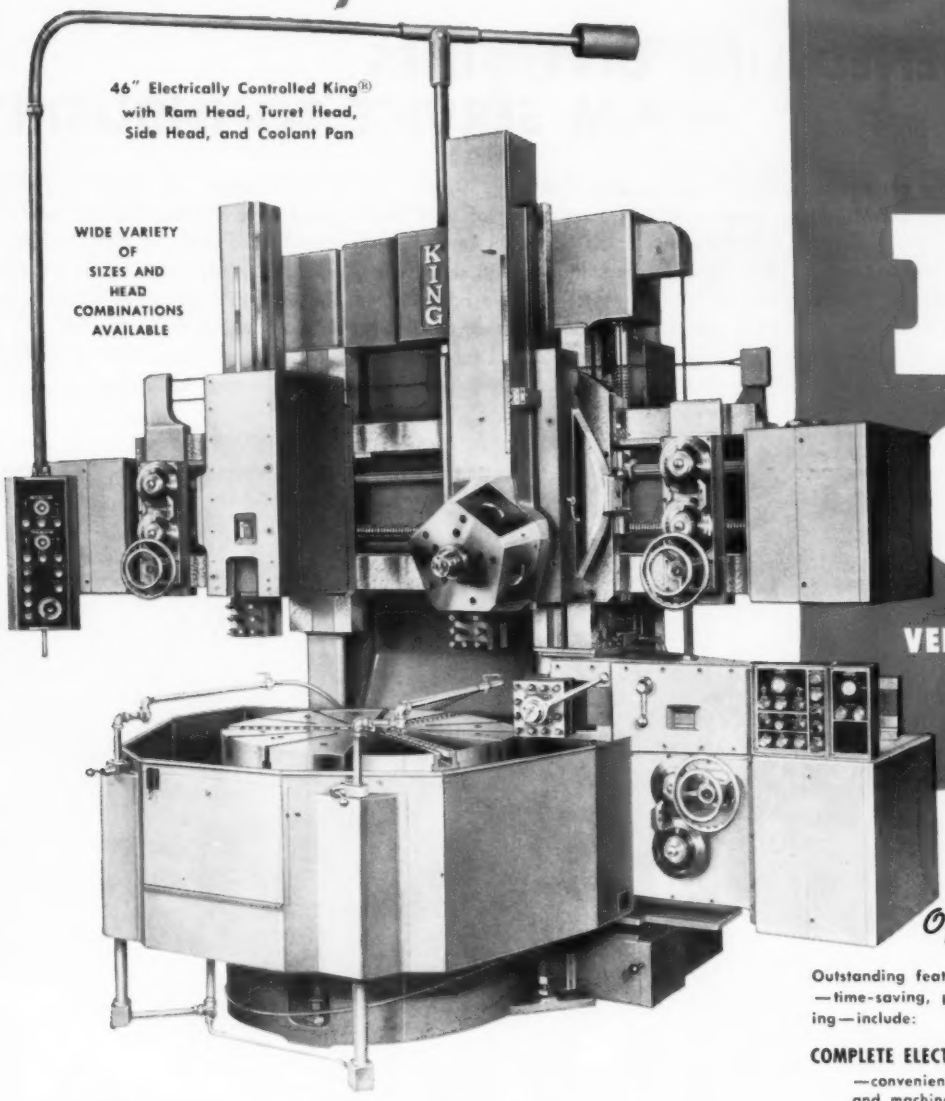
ALL NEW
Electrically Controlled



46" Electrically Controlled King® with Ram Head, Turret Head, Side Head, and Coolant Pan

WIDE VARIETY OF SIZES AND HEAD COMBINATIONS AVAILABLE

KING

VERTICAL BORING & TURNING MACHINES

Q. What will the new King do for you?

A. Give you the greatest productive capacity ever achieved for your vertical boring and turning work!

For full information see your King distributor, or write us direct.

AMERICAN STEEL FOUNDRIES • KING MACHINE TOOL DIVISION
1150 Tennessee Avenue
Cincinnati 29, Ohio

KING VERTICAL BORING & TURNING MACHINES

Many Advanced Construction and Operating Features

Outstanding features of the New King Machines —time-saving, production-increasing, cost-reducing—include:

COMPLETE ELECTRICAL CONTROLS
—conveniently located on movable pendant and machine-mounted panel.

INCREASED HORSEPOWER
40 and 50 H.P. on 30", 36", and 46" sizes, 75 and 100 H.P. on sizes 56" and up, available in any one of three speed ranges.

EXPANDED FEED AND SPEED RANGE
24 feeds from .0016" to .250" per revolution.
24 speeds in any one of three standard ranges —low, intermediate, or high.

DIALS FOR PRE-SELECTION OF FEEDS & SPEEDS

OUTSTANDING NEW SPINDLE & MOUNTING
—provides maximum table stability.

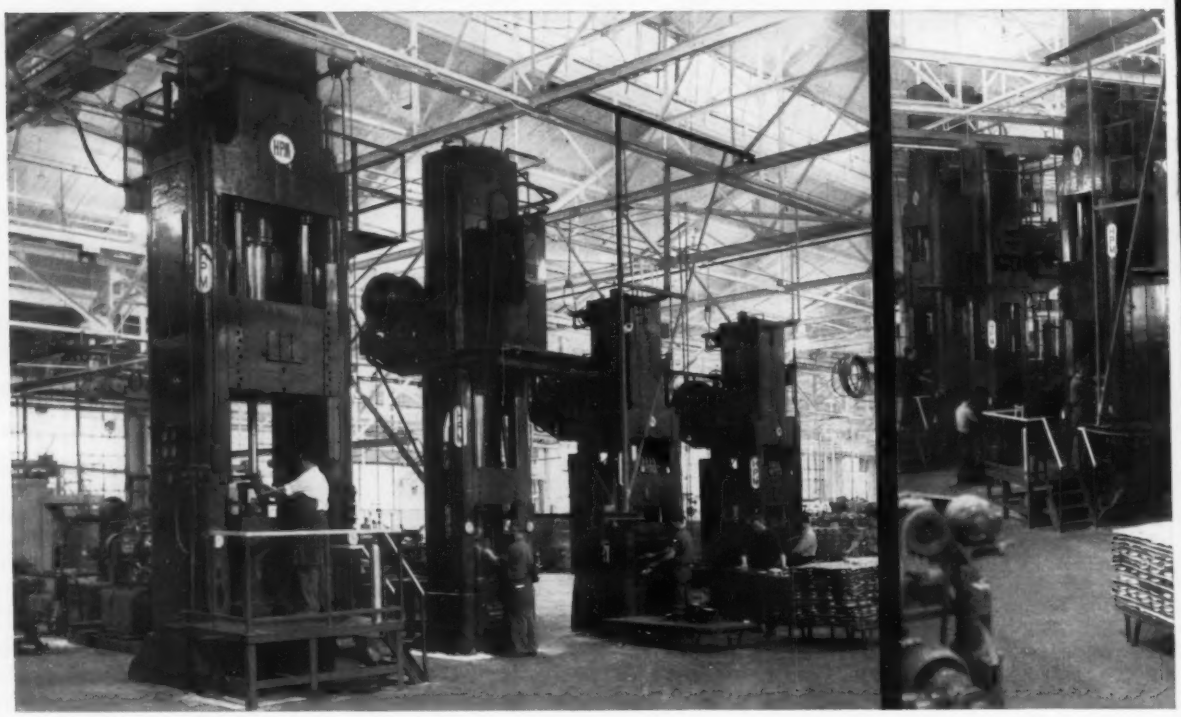
AUTOMATIC LUBRICATION

MACHINE ADAPTED FOR OPTIONAL ADDITION OF:
Automatic feed stops. Automatic cycling.
Automatic tracing control of heads.
Power indexing of turrets.
Non-metallic bearings on all gibs and bearing surfaces subject to sliding wear.

MORE H-P-Ms - IN MORE PLANTS

BROADENED LINE DIVERSIFIES H-P-M SERVICE TO INDUSTRY

Back in the early thirties, Rome Manufacturing Company, Division of Revere Copper and Brass Incorporated, began using H-P-M hydraulic presses in the manufacture of their now famous Revere Ware utensil line. Since that time, over twenty more H-P-Ms have been added in Revere plants. Literally hundreds of different dies are interchangeably used for the drawing and forming of sheet metal into the many forms used in Revere kitchen utensils. Revere is typical of industries that have adapted the principles of hydraulics—H-P-M hydraulics—to numerous metal forming operations because of their versatility, ease of maintenance and control, the infinite adjustability of tonnage, stroke and speed of ram traverse. All of these adjustments are at the operator's fingertips. Press operation for automatic and semiautomatic requirements is a matter of simple adjustment.



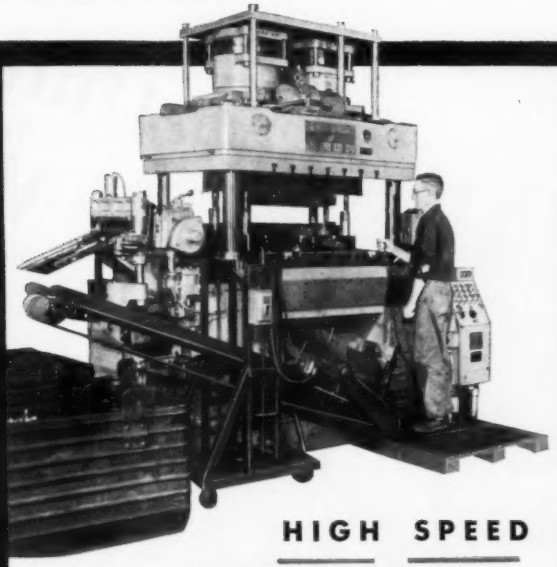
The complete H-P-M line has been illustrated and described in Bulletin 5600 and covers equipment drawing with and without die cushions, coining, embossing, straightening, rubber pad forming, forging, hot forming and trimming, and a variety of presses for the processing industries. Your request on your letterhead will send it to you by return mail.

THE HYDRAULIC

A DIVISION OF KOEHRING

-DOING MORE WORK

Adapting versatile H-P-Ms is a matter of tooling ingenuity and the application of experience your H-P-M field engineer will gladly supply. If your production facilities are undergoing modernization for the competitive days ahead, call in the H-P-M man in your area, or write to the home office in Mount Gilead, Ohio. Let the experience of our qualified engineers assist you at the planning stage.



HIGH SPEED WITH BUILT-IN ACCURACY ASSURANCE

A story of H-P-M Henry & Wrights in the automotive industry

Here's a machine, one of ten designed for a large automotive manufacturer expressly for the progressive stamping of parts on high production. Double crank design supports crosshead at both ends for accuracy; underdrive operation gives a low center of gravity and a pulling rather than a pushing action. Here's a dieing machine for greater range of work with better quality control at top speeds. It's JIC designed, which means less maintenance, better service for any requirement. And it's now made by H-P-M—a leader in metalworking presses since 1877. Send for complete information today.

Henry and Wright . . . built by H-P-M

Two different rows of H-P-M presses at Rome Manufacturing Company, Division of Revere Copper and Brass Incorporated, Rome, New York.

H801

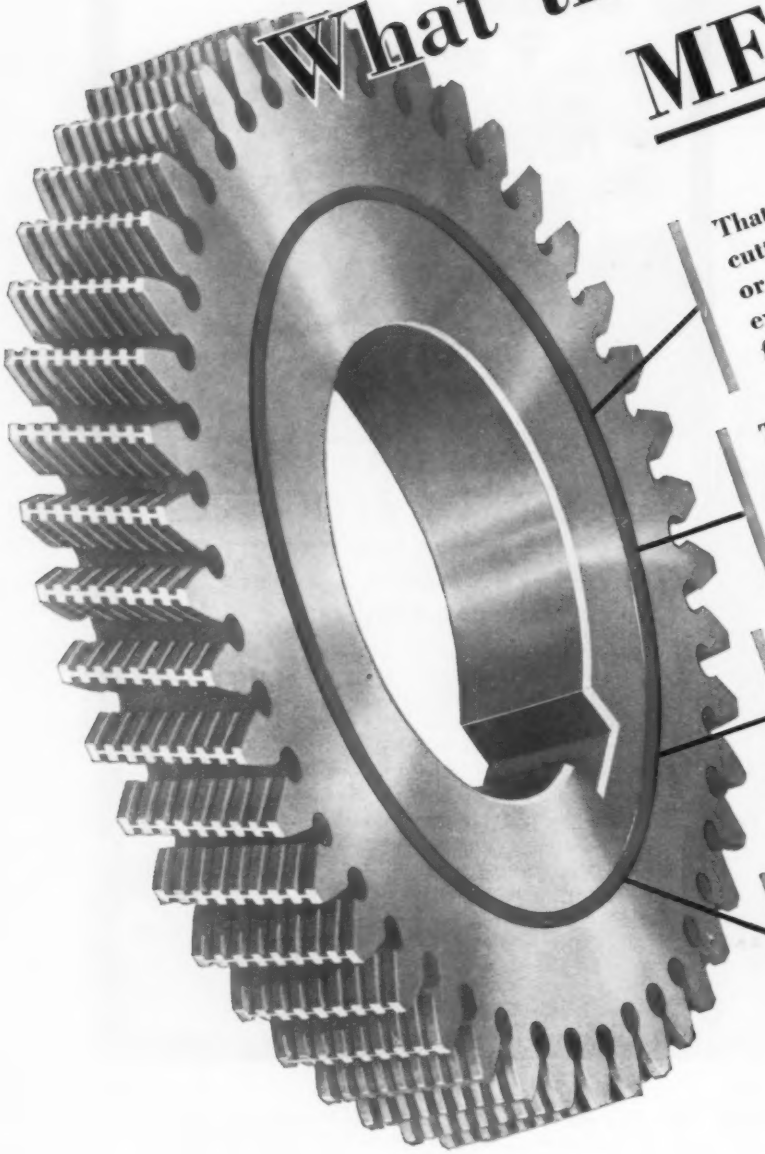
PRESS MFG. COMPANY

COMPANY • MOUNT GILEAD, OHIO, U.S.A.

HPM

For more information fill in page number on Inquiry Card, on page 227

What that Red Ring MEANS



That Red Ring on a gear shaving cutter means it was made by an organization which has more experience and success in this field than any other in the world.

That Red Ring marks the product of engineers and shop men who devote all their working time to these CUTTERS — nothing else.

That Red Ring reminds the user that these specialists are ready to help him get off the hook if he runs into a troublesome gear problem.

That Red Ring says "This cutter is designed and manufactured to deliver the best possible shaving performance."

Write for bulletin CR 56-10

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING
AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

7968

ANNOUNCING!

VICKERS® New ¼" Temperature and Pressure Compensated FLOW CONTROL VALVE

ANOTHER VICKERS FIRST

FOR OPERATING PRESSURES UP TO 2000 psi

For years the Machine Tool Industry has been asking for a combination Temperature and Pressure Compensated Flow Control Valve to insure CONSTANT FEED RATES. Now for the first time it is available as a production unit at a reasonable price.

Check THESE EXCLUSIVE FEATURES that mean Optimum Tool Life and Better Work Finish:

☑ **TEMPERATURE COMPENSATED**
Constant feed rates all day long with same throttle setting because throttle automatically compensates for changes in oil temperature. The compensator mechanism is simple in design and durable.

☑ **PRESSURE COMPENSATED**
Constant feed rate throughout entire cycle because built-in pressure hydrostat automatically compensates for load changes.

☑ **SINGLE THROTTLE COMPLETE RANGE ADJUSTMENT**
Greater flexibility because valve is adjustable within entire flow range of 5 to 1000 cubic inches per minute.

☑ **REVERSE FREE FLOW AS STANDARD FEATURE**
A standard feature which permits reverse free flow (up to 1400 cu. in. per min.) from outlet to inlet port by-passing control elements.

☑ **TAMPER-PROOF ADJUSTMENT**
Retension of original feed rate is assured because a set screw prevents inadvertent throttle movement and a cover over the set screw can be locked in place.

☑ **INTERCHANGEABLE**
This new valve replaces 12 previous models and it is interchangeable with all of them, also the drain connection is eliminated on the new valve to simplify piping.

☑ **GREATER ECONOMY**
No need to stock several valves for wide range of flow rates. Drain connection is eliminated, piping costs are reduced.

☑ **MAXIMUM RELIABILITY AND ACCURACY**
Design of temperature and pressure control components assures maximum circuit reliability and extreme accuracy of feed through a range of 5 to 1000 cubic inches per minute.

FOR ADDITIONAL INFORMATION SEND FOR I-195040

7945

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan

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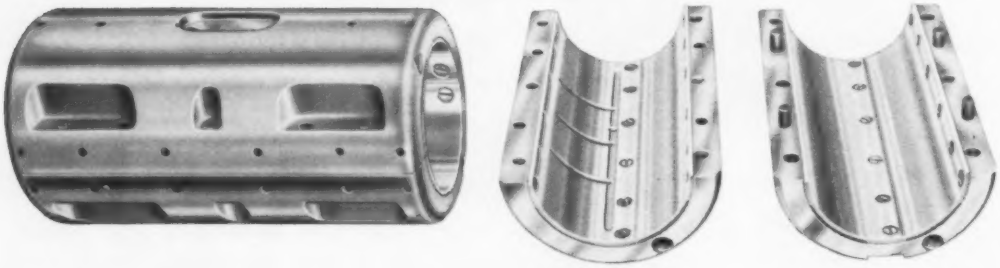
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information fill in page number on Inquiry Card, on page 227

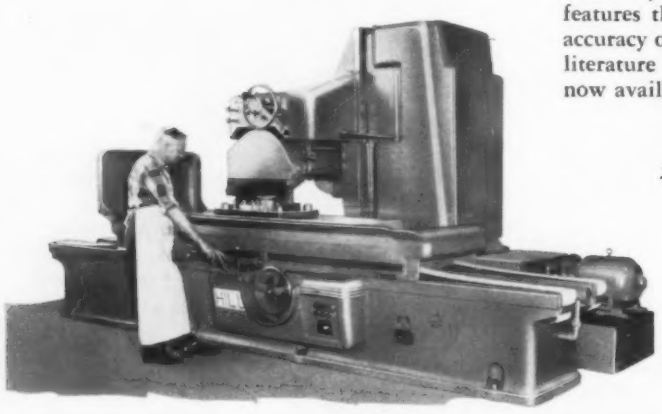
Novel Design provides *Astonishing Bearing Life*

The life of the HILL front spindle bearing on HILL horizontal spindle hydraulic surface grinders is truly astonishing. This bearing has been an *exclusive* HILL feature for more than 15 years. The necessity of replacement, under constant use, is practically unknown.



The front spindle bearing on HILL horizontal spindle hydraulic surface grinders was engineered by the HILL ACME COMPANY and has proven in the field to operate indefinitely. An alloy bronze bushing is fastened to a semi-steel casting with brass screws. The bronze bushing is undercut lengthwise in four equidistant locations on the outside diameter to allow for spindle expansion. (Darker areas in photo show undercut sections.) A perfect bearing surface is established in the I.D. of the bronze directly opposite the undercut sections. Oil is forced into specially designed concave relief areas which act as oil wedges assuring long bearing life. Hardened dowel pins guide the two halves together to their original position. The bottom half of the bearing has an oil return slot shown at the edge of the half section on the outside diameter. Note that there are NO oil grooves in this bottom half or in the quarter half of the top section. The shaft rotation spreads the oil film from the oil distribution grooves to the perfect bearing surfaces. Any additional oil grooves would act as scrapers and be detrimental to the oil film formed around the spindle.

This is just one of the many exclusive construction features that result in the longer life and permanent accuracy of HILL heavy duty surface grinders. Detailed literature on these high-precision machine tools is now available.



24" x 24" x 72" HILL horizontal spindle surface grinder grinding blanking dies to extremely close tolerances. Also built in Vertical Spindle design.

THE HILL ACME COMPANY

HILL DIVISION . . . . . **ESTABLISHED 1882**

1201 West 65th Street • **Cleveland 2, Ohio**

HILL-ACME TOOLS FOR INDUSTRY

"HILL" GRINDING & POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • ALSO MANUFACTURERS OF "ACME" FORGING • THREADING • TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • "CLEVELAND" KNIVES • SHEAR BLADES

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PERPLEXING ACTUATION AND TORQUE PROBLEMS!

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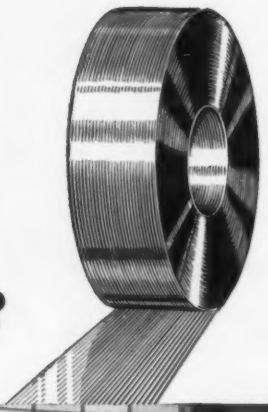
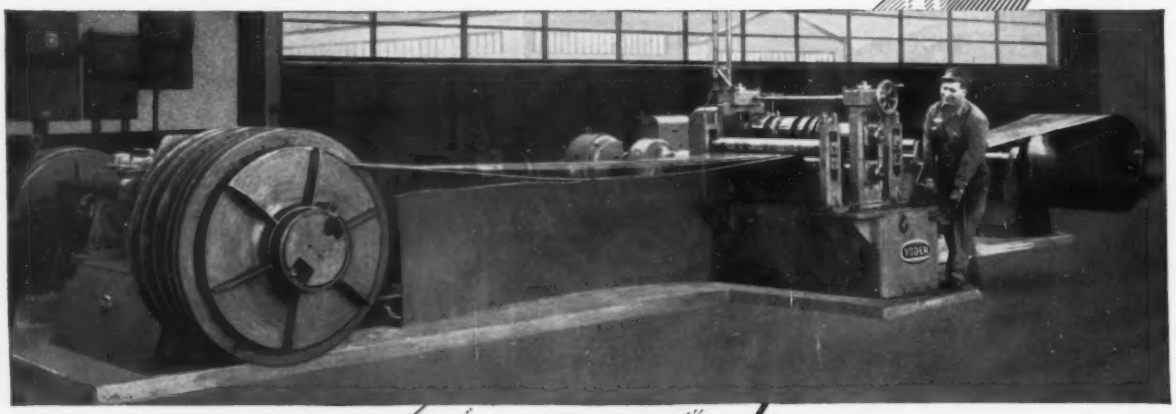
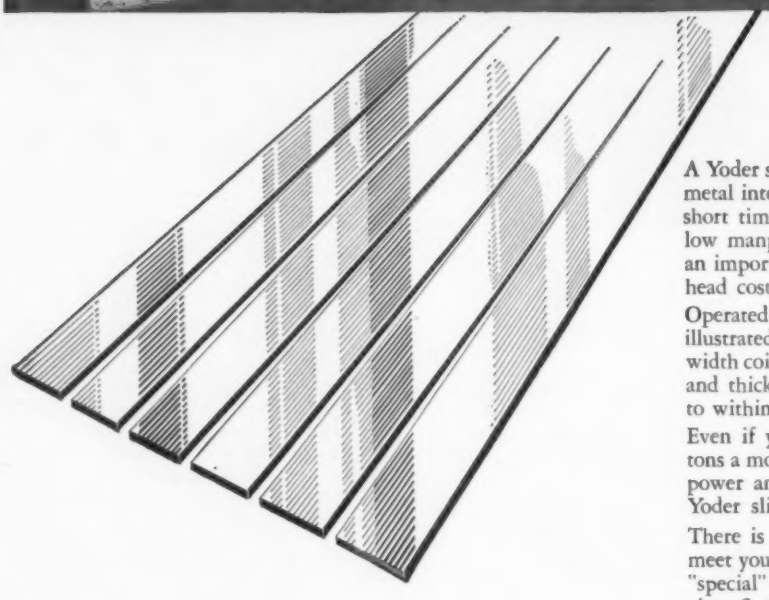
from cold strip to slit strands
IN SECONDS...
with a YODER
ROTARY MULTIPLE SLITTER







A Yoder slitter converts mill-width coils of flat-rolled metal into many variable-width strands in amazingly short time. Speed, coupled with great accuracy and low manpower requirements, makes a Yoder slitter an important factor in keeping production and overhead costs down.

Operated by only two men, the Yoder Type 3-48 slitter illustrated is designed to accommodate standard mill-width coils up to 48 inches wide, in a variety of metals and thicknesses. The slit strand widths can be held to within a .004" tolerance.

Even if your steel requirements are as little as 100 tons a month, the savings to be realized in time, manpower and raw material costs alone will pay for a Yoder slitter in the first few months of operation.

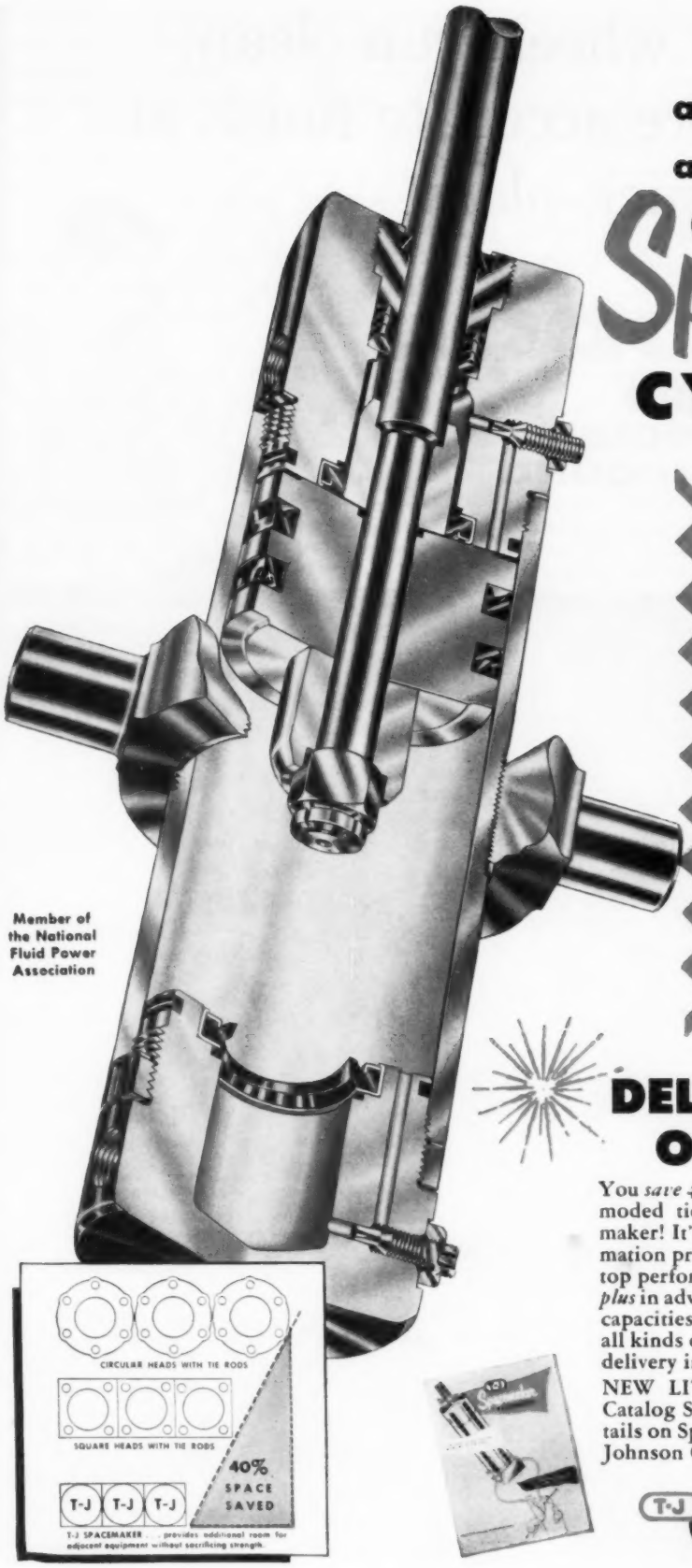
There is a Yoder slitter designed and engineered to meet your requirements, and to speed the delivery of "special" width stock in a wide range of large or small sizes. Send for your free copy of the fully-illustrated, 76-page booklet, "Multiple Rotary Slitting Lines."

THE YODER COMPANY
5504 Walworth Avenue • Cleveland 2, Ohio

ENGINEERING **YODER** MANUFACTURING

ROTARY SLITTING LINES
PIPE AND TUBE MILLS (ferrous or non-ferrous)
COLD ROLL FORMING MACHINES

all the EXTRAS are standard with T-J Spacemaker CYLINDERS



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- **NEW** *exclusive* ingenious cushion designs . . . Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Cushion for Oil.
- **STRONGER** than outmoded tie rod design, proven through actual tests. No tie rods to stretch.
- **SOLID STEEL HEADS** throughout the full line.
- **COMPACT DESIGN** eliminates tie rods, increasing the strength and reducing mounting space required, providing extra room for adjacent equipment.
- **HARD CHROME PLATED** body bores and piston rods . . . assure you of long trouble-free service. (Standard at no extra cost.)
- **METALLIC ROD SCRAPER**, not just a wiper, actually removes foreign matter from the rod.
- **PILOTED PACKING GLAND** with extra long bearing. Additional strength and support to the piston rod.
- **OIL** pressure to 750 p.s.i. AIR to 200 p.s.i.

CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J
T-J
T-J
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

DELIVERY OFF THE SHELF!

You *save 40% space* when you switch from outmoded tie rod cylinders to the T-J Spacemaker! It's stronger, too! Fits right into automation programs in countless plants. Delivers top performance and dependability with a big *plus* in advanced features. Wide range of styles, capacities . . . reduces man-hours and costs in all kinds of push-pull-lift operations. Off-shelf delivery in 64,000 combinations!

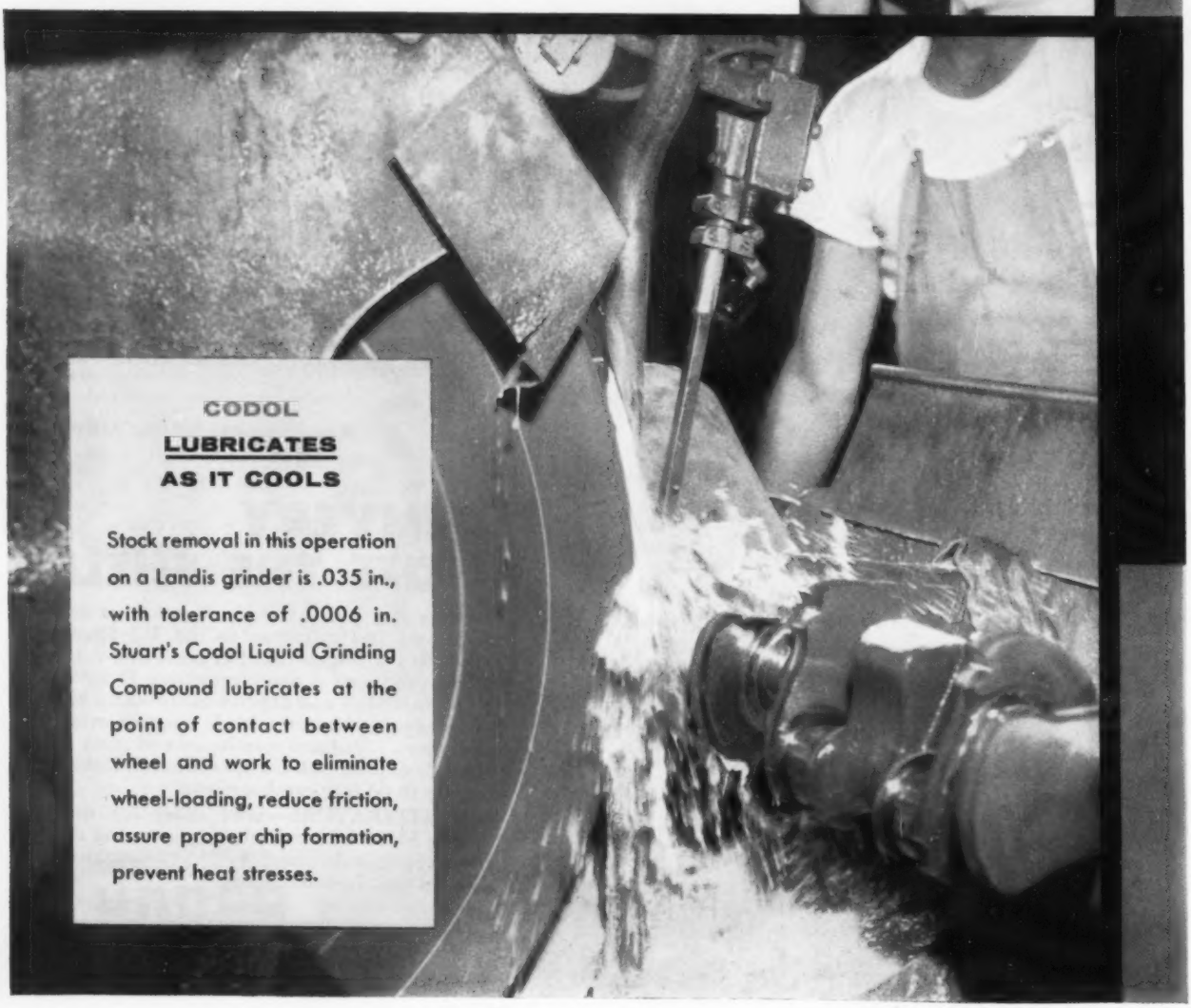
NEW LITERATURE—Send today for new Catalog SM56 with complete engineering details on Spacemaker line. Write The Tomkins-Johnson Co., Jackson, Mich.

T-J TOMKINS-JOHNSON
RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

Now grinding wheels run clean, give finer, more accurate finish at "big-three" truck plant

Stuart

CODOL
LIQUID GRINDING COMPOUND



CODOL
LUBRICATES AS IT COOLS

Stock removal in this operation on a Landis grinder is .035 in., with tolerance of .0006 in. Stuart's Codol Liquid Grinding Compound lubricates at the point of contact between wheel and work to eliminate wheel-loading, reduce friction, assure proper chip formation, prevent heat stresses.

Now that about 30 grinding machines in the crankshaft and other departments of this truck manufacturing plant are using Stuart's Codol Liquid Grinding Compound, all hands agree that results are much better, problems greatly reduced. Wheel-loading and burning, which were problems with a coolant previously used, are now eliminated and a distinct improvement in finish is noticeable. Codol efficiently cleans both wheel and work, drops all chips in the tank, and returns clean. Rusting, also once a problem, is now absent. Effective cleansing and superior lubricity characteristics keep temperatures down, eliminate burning, and improve accuracy.

On-the-job economies with Codol add up to a substantial saving on costs experienced before. The previous compound had to be mixed one part coolant to 30 parts water. Excellent results are now achieved mixing one part Codol in 60 or 70 parts water. Clean-running wheels last longer, produce more parts. The previous coolant often went sour in a few days—Codol stays fresh for the full period between scheduled chip clean-outs.

HERE'S WHAT THEY SAY ABOUT STUART'S CODOL:

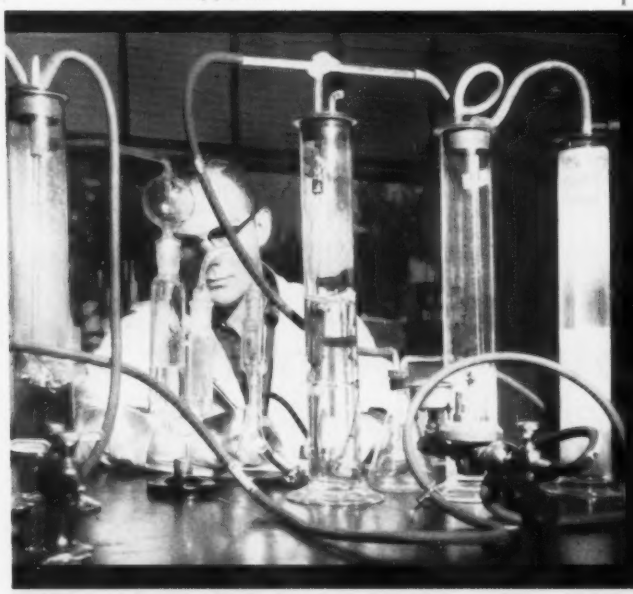
"The wheel doesn't load up as it did before . . . finish is much improved . . . work runs cool, and this gives us improved accuracy . . . gives us more cuts per wheel."—grinding machine operator

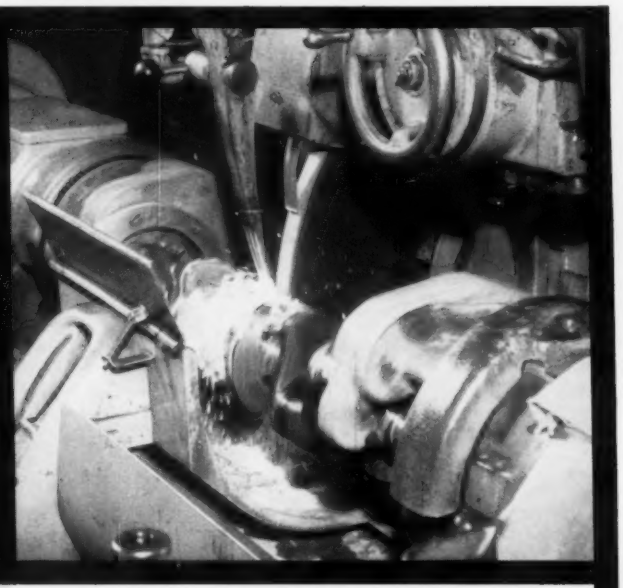
"Wheel-loading and burning used to be serious problems. Now, we get better corners and no burning of the side wall. Codol permits us to run without pumping until the tank is almost full of sludge."—foreman

"Now we have no rusting whatever. Another point—we leave our Codol standing over the week end and have no worries about its deteriorating and going rancid"—grinding machine operator

The plant's engineering laboratories tested numerous coolant materials and reported Codol to be unsurpassed as a remedy for the wheel-loading problem.

Codol eliminates tearing and scratching of the finish and has earned full credit for a marked increase in wheel life on thirty grinders throughout the plant.





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Arrange now to test Stuart's Codol Liquid Grinding Compound on your difficult grinding operations.

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OSBORN®

BEFORE BRUSHING—*Jet engine parts formerly hand-filed and emery-rubbed to remove burrs and sharp edges.* Hand-finishing time: 80 minutes.

AFTER BRUSHING—*Burrs are thoroughly removed, edges and surface junctures are blended to radius tolerances . . . each part is precision-finished quickly, uniformly.* Osborn Brushamatic® finishing time: 8 minutes.

Flying finish for jet engine parts

...10 times as fast with precision OSBORN Brushamatic® Methods

JET ENGINE COMPONENTS *are precision finished automatically at high production rates on Osborn Brushamatic® 51-OOL Machine.*

HERE'S how a jet engine manufacturer has broken a production bottleneck . . . saved dollars and days in the precision-finishing of jet engine components . . . with Osborn Brushamatic® Methods.

Sharp edges, burrs or scratches on components cause stress concentrations and resulting fractures—so a high degree of surface refinement is essential. *Tedious hand finishing each of these parts used to take 80 minutes.* Still, job quality was inconsistent . . . costly in time and money.

Today, Osborn Brushamatic does the same job in 8 minutes . . . 10 times as fast . . . with a high-quality, uniform finish held to micro-inch specifications.

It's typical of how Osborn Power Brushing works to help *you* speed production . . . cut costs . . . improve product quality. An **O**sborn **B**rushing **A**nalysis, made in your plant at no obligation, will show you how. Write us for details—and for your copy of the 20-page Brushamatic® booklet. *The Osborn Manufacturing Company, Dept. D-41, Cleveland 14, Ohio.*

Osborn Brushes

BRUSHING MACHINES • BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • FOUNDRY PRODUCTION MACHINERY

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CENTERLESS
PRECISION LAPPER

Finish Lap Your Machine Tool Output With
SIZE CONTROL CENTERLESS LAPPER

An accurate and simple finishing operation; for reducing oversize gages to correct size; for lapping worn plug gages to next lowest size; for lapping bearings, bushings, shafts, and any cylindrical part which requires close tolerance and fine finish. Eliminates ring lapping. Laps either straight or tapered plugs and pins with or without shoulders and handles a wide range of diameters. No special tooling is required. A simple adjustment to vary the space between the rolls permits lapping any diameter from .010—6" with practically no time lost. Roll speeds may be adjusted to suit all requirements.

model 200 (Pat. No. 2465178) complete with 2 sets of rolls ground for precision work—1 set for roughing—1 set for finishing; vibrationless drive; 1 only ½ h.p. motor, AC, 220/440 volt, 3 phase, installed; 1 cabinet; 1 set of 3 lapping sticks; 1 jar lapping compound; 1 set of instructions.

complete and ready to plug in, net . . **$1,095.00**

accessories:

hold-down lever **$195.00**

tru-dresser **75.00**

model 100—complete with 1 set of rolls for roughing and finishing. Large roll 6" x 5¾" diameter, small roll 6" x 3" diameter. Other specifications same as for model 200. Complete, **$850.00**

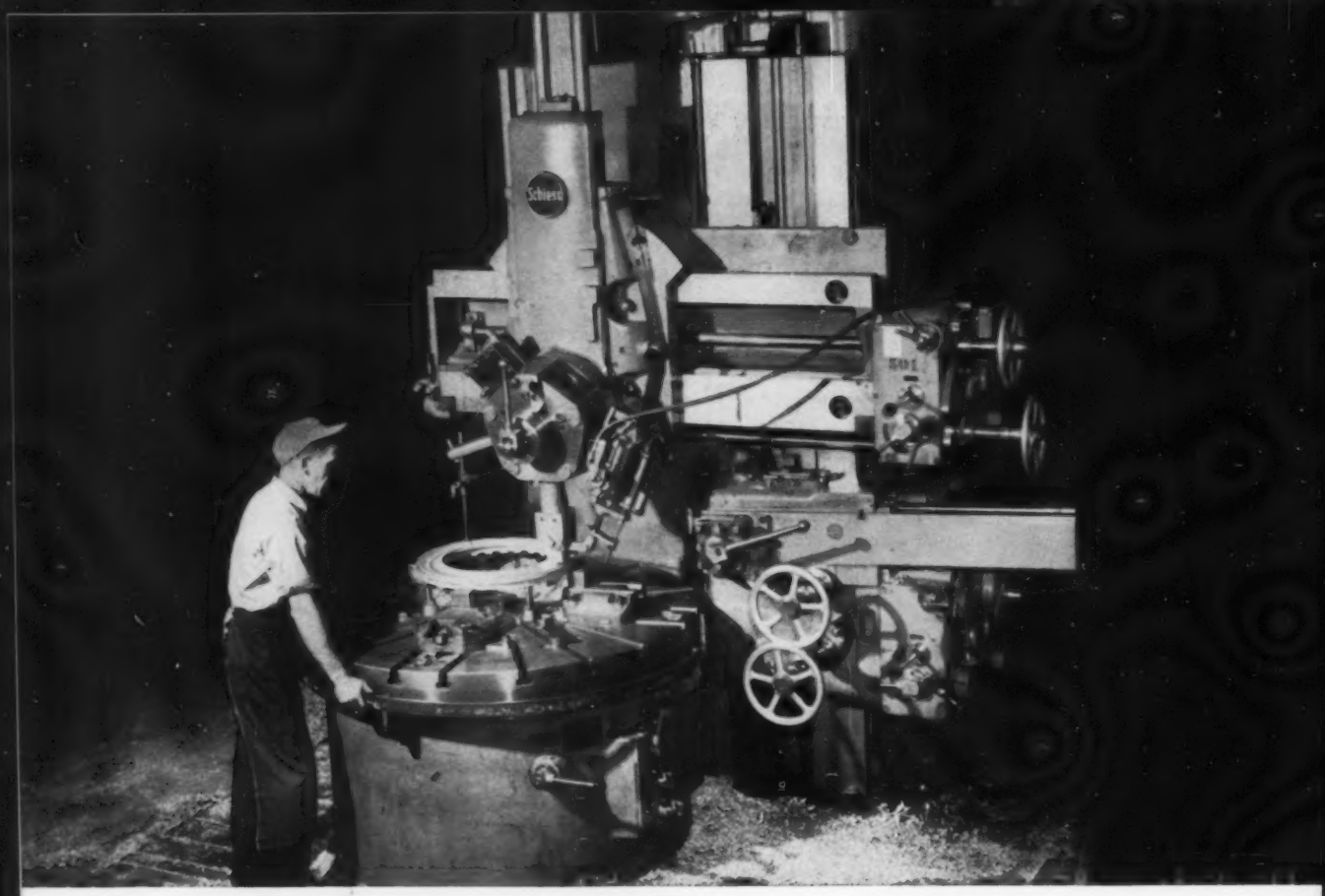
model 200

SPECIAL GAGES

Size Control is equipped to supply special gages in limited or production quantities. Gages can be made to customer's specifications—or recommendations made without obligation

Illustrated is a small selection of flush pin, special snap gages, concentricity and depth plugs, flat gages, ring gages and profile gages made by this department.

SIZE CONTROL COMPANY
2500 West Washington Boulevard
CHICAGO 12 ILLINOIS MOnroe 6-6710



"Now, with our Schiess vertical turret lathe

one 8-hour shift does the work of three!"

says Arnold R. Kline, plant manager, O.K. Rubber, Inc., Littleton, Colo.

Schiess 13EK-150 Vertical Turret Lathe turning a 33 in. "Nu-Matic" tire mold sidewall plate, made of #12 cast aluminum.

"Production on sidewall tire molds jumped 300%. Material spoilage was reduced 50 to 60%. Per unit cost dropped 60%. And we have a better machined end product!" That's the way Arnold Kline wraps up the production story at O.K. Rubber, since he installed this Schiess machine.

He continues: "We've got the Schiess mill doing everything from boring 1¼ in. holes to turning plates 56 in. in diameter. We thought we'd need a custom-made mill to do our kind of work. We don't think that way any more."

"And frankly, we were amazed at the price—30 to 40% lower than we expected!"

No costly training time was needed. Skilled machinists were checked out on the mill in just a few hours. Operators particularly liked the horizontal head, the rapid traverse lever, the cross-rail mechanical controls. All contributing to greater accuracy . . . better finish . . . less machining time.

Get to know this and other products of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be happy to help you select the proper tool for your production needs. Write today.

SCHIESS

AMERICAN SCHIESS CORPORATION • 1232 Penn Avenue, Pittsburgh 22, Pa.

this 480 ton giant has 5 heads

WALDRICH SIEGEN

combined planer and milling machine

No need to risk the inaccuracies that come from moving a workpiece weighing up to 100 tons from machine to machine for different operations. One set-up is all you need with this Waldrich Siegen machine. And just think of the tremendous savings in set-up time and costs.

Three milling heads take care of milling, boring and thread cutting operations; another head does planing and grinding; and there's a planer side head, too.

The Waldrich patented tool retracting mechanism in the planer head raises tool in a straight vertical plane after unclamping, repositions tool automatically, then reclamps. Cross rail is clamped hydraulically in exact horizontal position, located by separate electric drive. Built-in optics confirm accurate location.

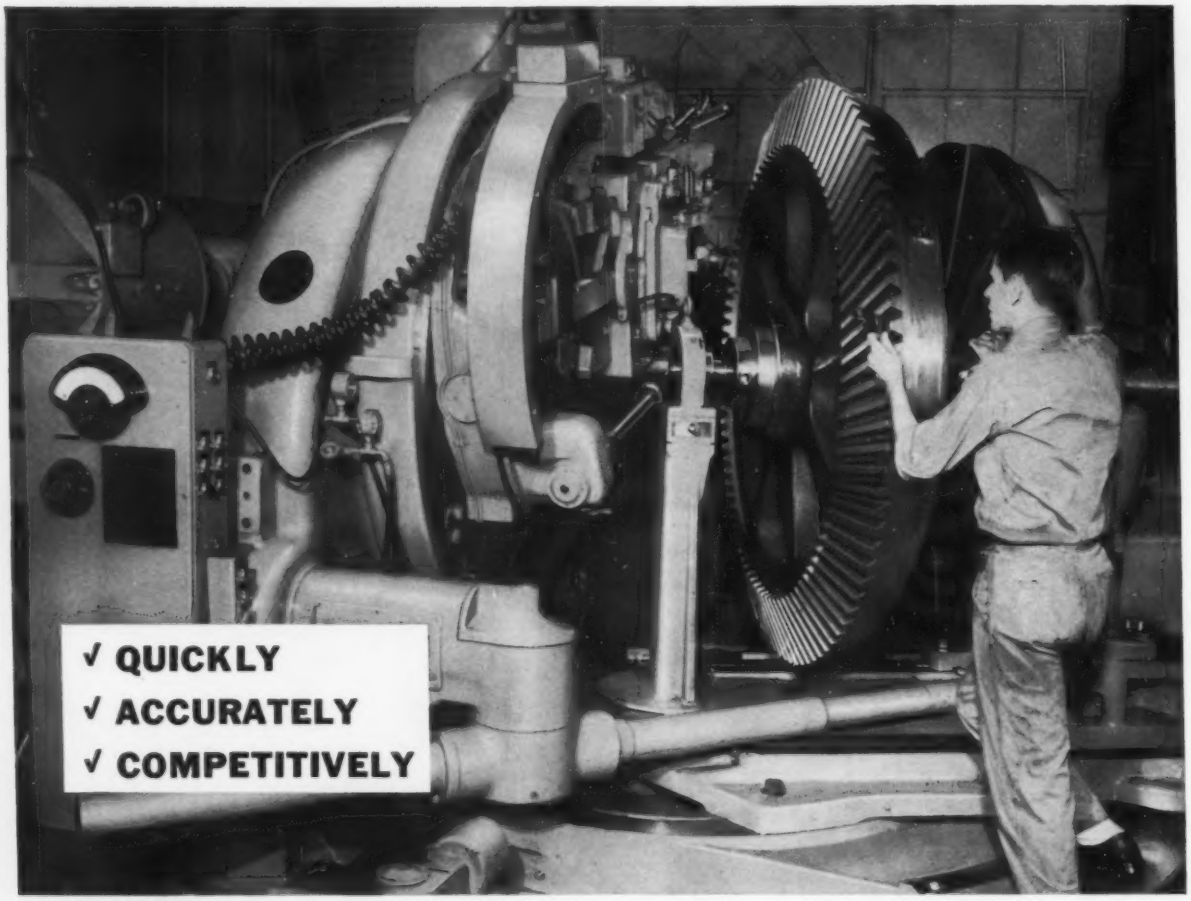
Rigid, you bet—from top to bottom! Waldrich construction features a base plate crossing under machine and tying columns and bed into one ruggedly rigid unit. And there's a total of 900 h.p. working for you.

Write for all the specs on this mammoth producer. And ask a Waldrich engineer to discuss them in detail—in terms of your production needs.

WALDRICH SIEGEN

american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANIA



phillie gear...spiral bevel gears to 72" diameter

PHILLIE GEAR'S new #70 Bevel Gear Generator will cut the widest possible selection of Spiral-Bevel, Zerol and Hypoid Gears, in diameters up to 72", and face widths to 10". Even in these massive sizes, accuracy of tooth form and optimum load carrying characteristics of pinion and gear are positively assured.

Philadelphia Spiral Bevel Gearing is hardened to produce a tool-like surface, yet, retain a resilient core to withstand high shock loading. Finally, every gear set is lapped on special test machines to ensure best possible tooth bearing.

Philadelphia Spiral Bevel Gears—in any quantity, size, and ratio are quickly and correctly manufactured to your specifications.

The installation of this modern gear generator, is another step forward in making Phillie Gear one of the World's best equipped, largest and most progressive gear manufacturing plants. Your inquiries will be fully analyzed to provide the most economical and satisfactory gearing obtainable—also whenever requested Philadelphia engineers will make a stress analysis of gear loading to further insure satisfactory operation.

Send for the Philadelphia Gear Design Manual G-655—kindly use your business letterhead.

phillie gear ®

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INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

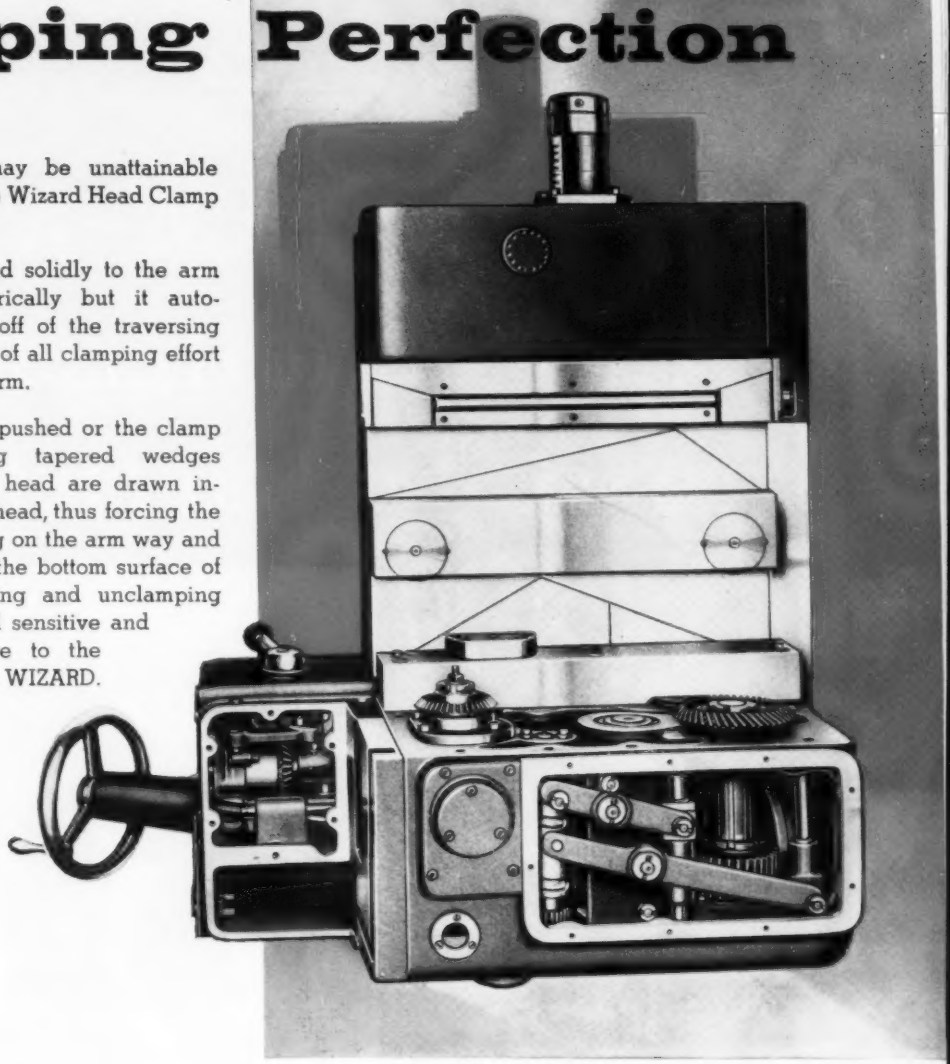
For more information fill in page number on Inquiry Card, on page 227

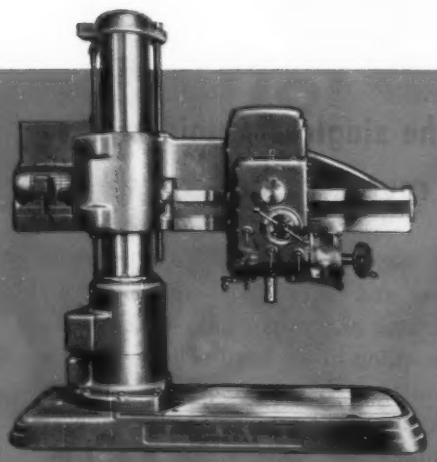
Clamping Perfection

Theoretically perfection may be unattainable but practically the new Hole Wizard Head Clamp is perfect.

It not only clamps the head solidly to the arm either manually or electrically but it automatically raises the head off of the traversing rollers, thus relieving them of all clamping effort and binds it solidly to the arm.

When the clamp button is pushed or the clamp lever actuated, opposing tapered wedges between the arm and the head are drawn inwardly at each side of the head, thus forcing the head off of its roller bearing on the arm way and wedging it solidly against the bottom surface of of the arm. This clamping and unclamping action is instantaneous and sensitive and adds another plus feature to the "AMERICAN" NEW HOLE WIZARD.





Plus features

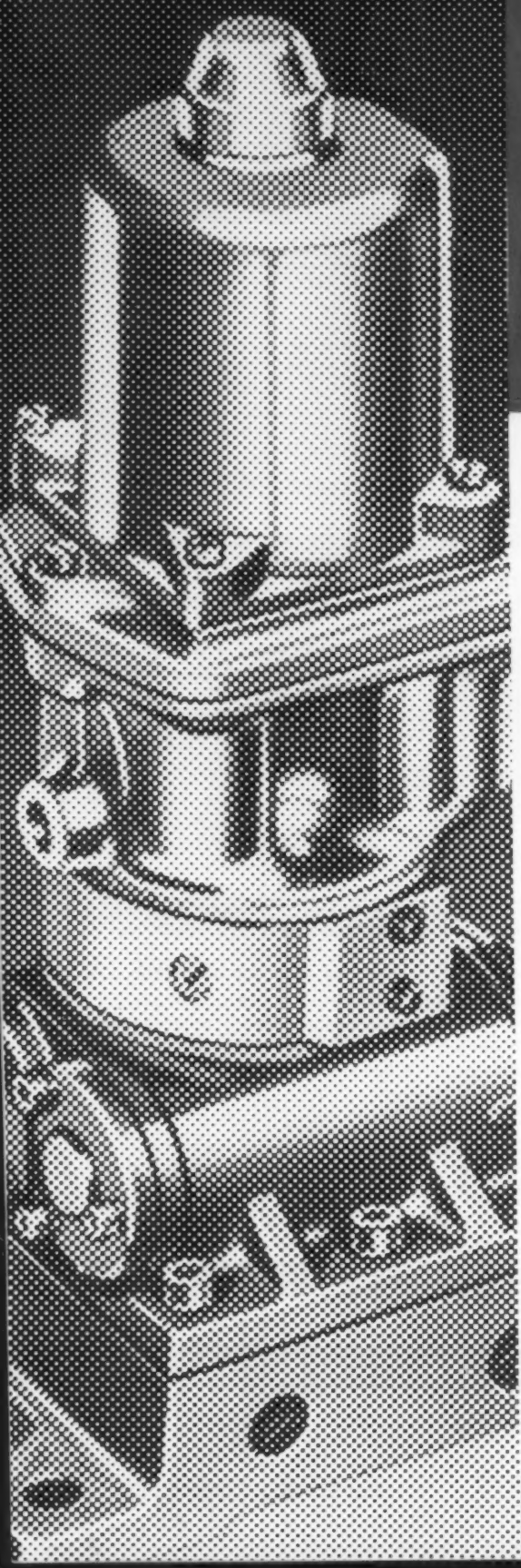
Speaking of Plus Features here are a few you will want in your next radial.

- Centralized Control.
- Lightning-fast Direct Reading Speed Change.
- Nitrided Spindle and Sleeve—practically wear proof.
- Timken mounted column unit defies deflection.
- Raybestos covered, spring steel tapping attachment friction bands, quick acting, wear proof, permitting 40% speed-up for spindle reverse.

These are just a few . . .
learn the others from bulletin No. 328

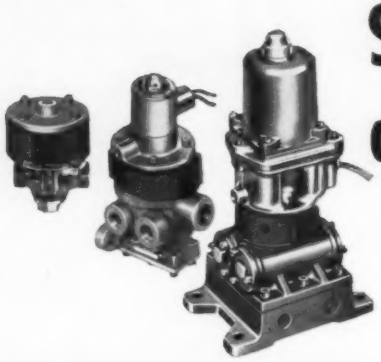
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



NEW-A totally different type momentary!

Ross Skyline **Double Stroke adapter**



Each time the single solenoid strokes the valve reverses and stays put

An air operated model is also available with which the valve reverses and stays "put" with every air impulse (pressurizing and exhausting) delivered to the single pipe opening in the head. The secret is a two part cycle in the adapter wafer which inserts between any skyline head and any skyline body. Hundreds of applications. Save space. Save cost. Save maintenance. *Do jobs never before possible.* Write for full details in bulletin 316.

Air Controls With Engineering and Ingenuity

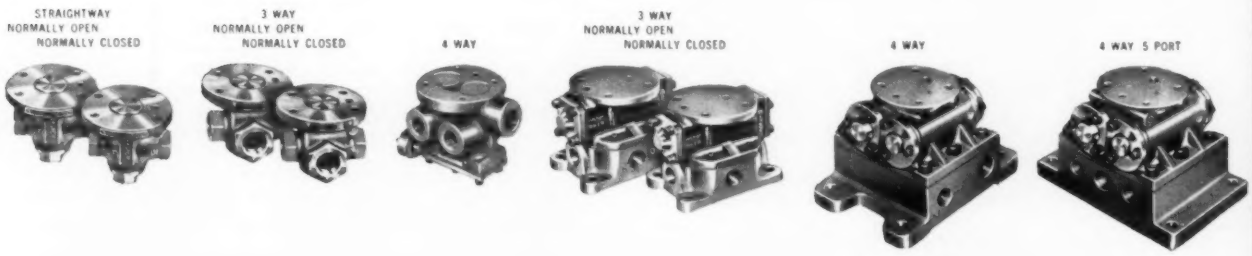
Ross OPERATING VALVE COMPANY

110 EAST GOLDEN GATE AVENUE • DETROIT 3, MICH.

Ross Skyline

Now-All the basic valves-*and more*-in this *long life* air valve series

match any head to any valve body!


STRAIGHTWAY NORMALLY OPEN NORMALLY CLOSED
3 WAY NORMALLY OPEN NORMALLY CLOSED
4 WAY
3 WAY NORMALLY OPEN NORMALLY CLOSED
4 WAY
4 WAY 5 PORT

Now there are 11 heads and nine bodies to meet both usual and unique problems in the line which was designed to give you the longest life and greatest adaptability of any valve line in the world. All heads are readily interchangeable with all Skyline valve bodies, and the new Double-Stroke momentary adapter further multiplies the number of valve combinations. What is your problem? Drop us a note explaining it, or call your nearby Ross field service engineer for details on the Skyline valve to solve it.

Combining Engineering With Ingenuity for Better Air Control

Ross OPERATING VALVE COMPANY

110 EAST GOLDEN GATE AVENUE • DETROIT 3, MICHIGAN

COMPARE!

the inside design features of 4 leading dial indicators

COMPARATIVE ANALYSIS OF SEVEN ESSENTIAL INDICATOR COMPONENTS

● INDICATES HIGHEST RATING

HARDNESS READINGS FROM ROCKWELL "C" SCALE

	SPINDLE HARDNESS	PINION TEETH HARDNESS	PIVOT HARDNESS	BRONZE BEARINGS	REMOVABLE BEARINGS	SHOCKPROOF AT SPINDLE	SHOCKPROOF AT NO EXTRA COST
STANDARD GAGE	RC 59	RC 55	RC 55	YES	YES	YES	YES
MAKE A	RC 25	RC 55	RC 55	No	No	No	No
MAKE B	RC 25	RC 25	RC 25	No	No	No	No
MAKE C	RC 43	RC 43	RC 43	YES	YES	YES	No

In addition to features listed in this chart, STANDARD Dial Indicators have lapped pinion teeth, burnished pivots and highly polished spindles.

Superior Construction Invariably Leads To Better Performance

Firms keeping accurate records of indicator servicing show lowest *in-use* costs for STANDARD dial indicators. Spindle and pinion teeth hardness, bronze bearings and superior finish virtually eliminate normal wear! See these features in the *Man-from-Standard's* new do-it-yourself test kit.

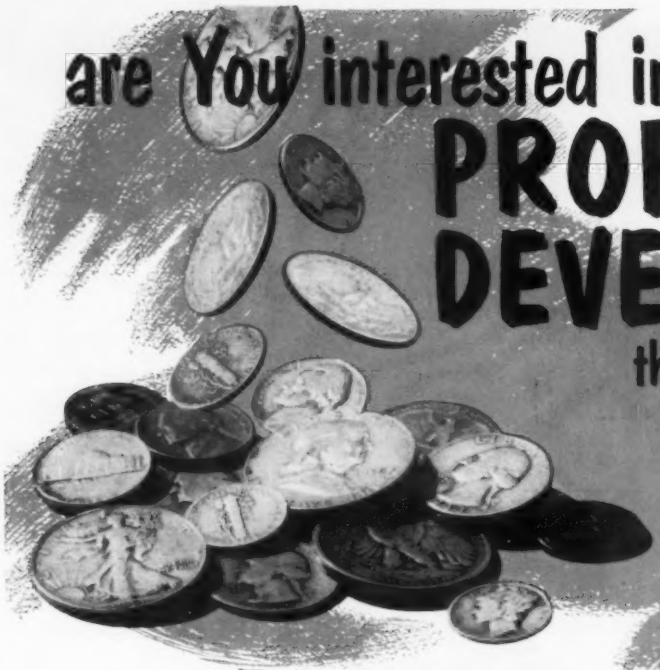
STANDARD® SINCE 1925 GAGE COMPANY, INC. POUGHKEEPSIE, N.Y.

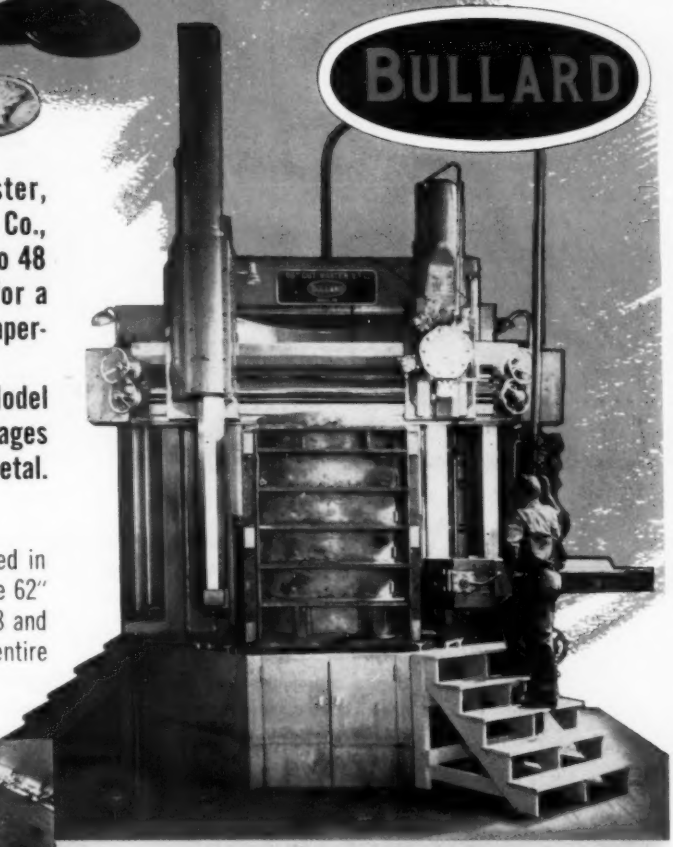
A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE TYPES

For more information fill in page number on Inquiry Card, on page 227

are You interested in PROFIT DEVELOPMENT

through reduced machining time and Lower Costs . . .

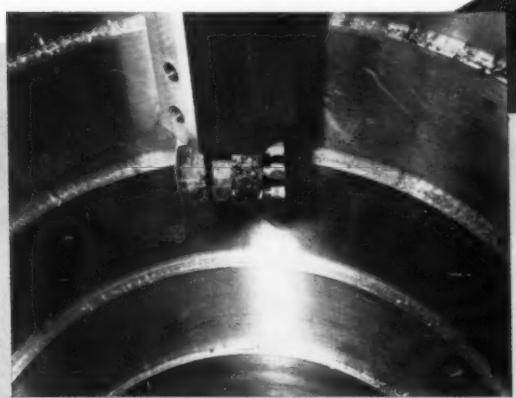




The new 66" Bullard Cut Master, Model 75 purchased by E.D. Jones & Sons Co., Pittsfield, Mass., has reduced from 65 to 48 hours the machining time required for a 4,000 lb. stainless steel piece used in a paper-making machine.

The Bullard Cut Master V.T.L., Model 75 line offers many features and advantages to help you — cut costs when cutting metal.

The part, 68" high, formerly had to be machined in three operations. Now, with an extension on the 62" Ram, a table speed of 9.6 r.p.m., feed of .0208 and ⅛" depth of cut, it is possible to machine the entire depth in one operation.



Close-up showing step boring and facing operation with 370 grade carboloy tool.

Complete details are available from your nearest Bullard Sales Office or Distributor or write

THE BULLARD COMPANY

BRIDGEPORT 9, CONNECTICUT

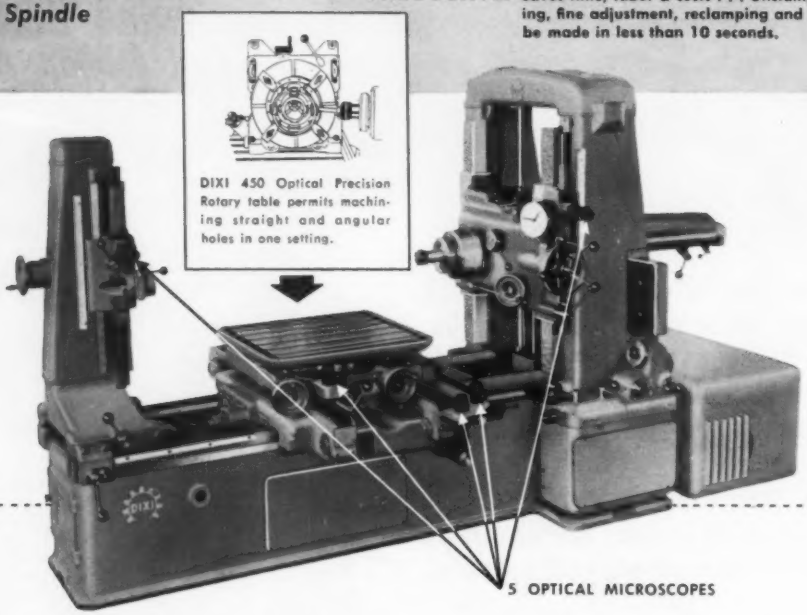
DIXI 60 *horizontal optical jig borer*

The ONLY Horizontal Jig Borer Built Today! Combines the ACCURACY of the Vertical Spindle With the VERSATILITY of the Horizontal Spindle

ACCURATE: Optical settings provide an overall accuracy of .0002.

VERSATILE: Optical settings for operations in all planes and compound angles . . . equally suitable for tooling, short-run or production work . . . permits JIGLESS boring, facing, milling and drilling.

PRODUCTIVE: Saves time, labor & costs . . . Unclamping, positioning, fine adjustment, reclamping and rechecking can be made in less than 10 seconds.


DIXI 450 Optical Precision Rotary table permits machining straight and angular holes in one setting.
5 OPTICAL MICROSCOPES

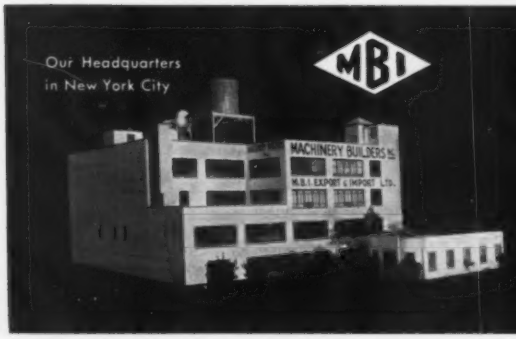
The DIXI Optical Reversing Process assures perfect alignment as well as round, taper-free holes. In work pieces with line bores on opposite sides, this is obtained by optically indexing the built-in rotary table 180°, locking the spindle feed and using the hydraulic table in-feed instead. Electrical infinitely variable speed spindle drive; infinitely variable hydraulic feeds; special features eliminate effect of spindle over hang on accuracy.

Made in Switzerland All measurements in inches

- Guaranteed service by factory trained staff
- Engineering staff available for consultation
- Spare Parts in New York stock
- Your operators trained

DIXI 60 now in wide use in leading aircraft and manufacturing plants throughout the United States.

THIS VERSATILE MACHINE IN OPERATION at our New York, and other conveniently located Demonstration Centers.



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export & import ltd.

A Division of Machinery Builders, Inc.

475 Grand Concourse, Bronx 51, New York

"Over 25 years experience in designing & building machinery"

For more information fill in page number on Inquiry Card, on page 227

TOOL LIFE INCREASED 400%

CLEVELAND Carbide Tipped Adjustable Reamer sets new high record!

The specifications on this job call for reaming a 4½" hole to a tolerance of .001" and a surface finish of less than 50 R.M.S. (micro-finish). CLEVELAND Carbide Tipped Adjustable Reamers are meeting these requirements day after day... month after month... *and reaming five times as many holes per grind as the conventional high speed reamers formerly used.*

Whenever *you* have a difficult reaming problem, a CLEVELAND Service Representative can help you. Contact our nearest Stockroom, or...

Request your copy of this descriptive booklet on CLEVELAND Carbide Tipped and Solid Carbide Cutting Tools

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

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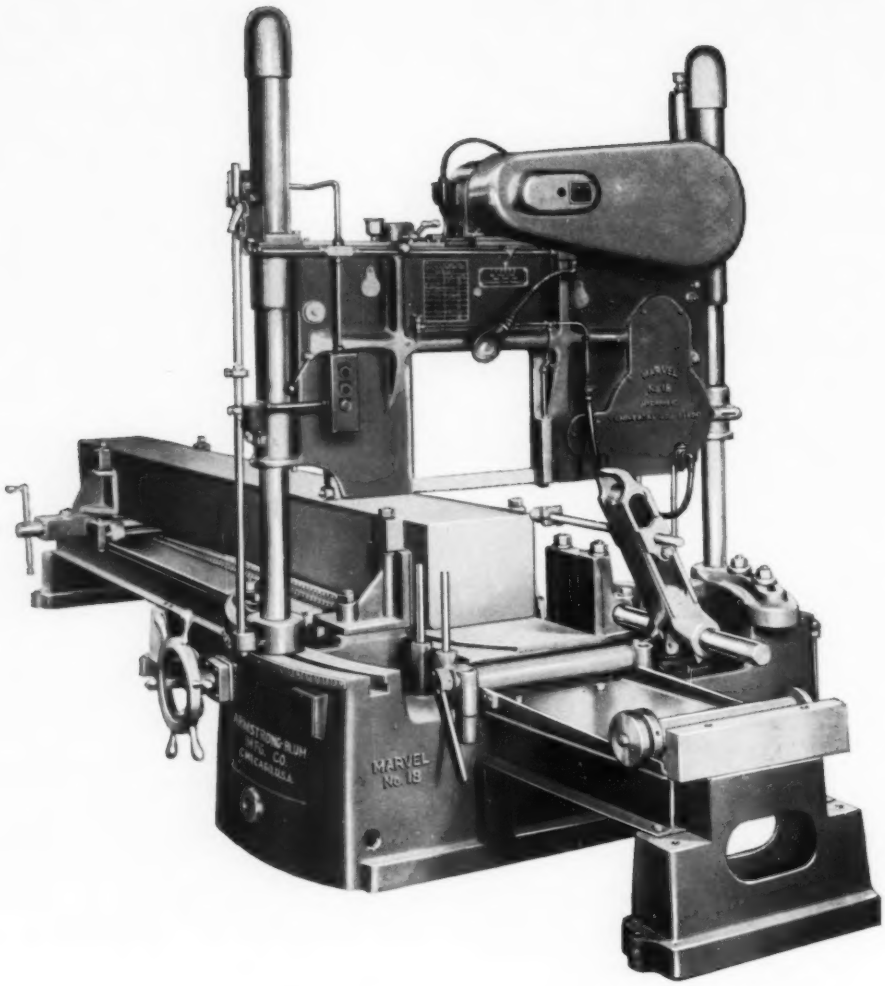


No Job too big or too tough . . .

for MARVEL "*Giant*" Hack Saws

These giant MARVEL Hydraulic Hack Saws (No. 18, Capacity 18″ x 18″; and No. 24, Capacity 24″ x 24″) were *basically* designed for rapid and economical cut-off of BIG WORK. They are not merely "conventional" designs "stretched" to big capacity. They are truly designed and built with the ruggedness and rigidity necessary to withstand the rough treatment of sawing big work, even though the work is in the "toughest of the tough" alloys.

They are reliably fulfilling the cut-off requirements in innumerable steel mills, forge shops, structural shops, warehouses, and machine shops, with assured low tool cost and minimum kerf loss of steel.

In addition to cutting-off, they are reducing costs by eliminating further machining operations. Heat treated die blocks are being reclaimed for re-sinking by sawing off the worn face; columns, beams, pipe, and tubing are being sawed to *finished*, square ends, eliminating milling; angular sawing is done conveniently by swinging the upper structure on the base, to any angle up to 45 degrees—*without moving the work*.

Contemplating the modern trend toward ever tougher steels and larger sizes, these are the logical sawing machines to buy, not only for today's needs but for tomorrow's as well.

Write for Catalog

Metal Cutting MARVEL SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.

For more information fill in page number on Inquiry Card, on page 227

Are you taking full advantage of FREE ENTERPRISE *within your own business?*

The privilege of buying new machinery and replacing old machinery and equipment is one of the healthiest opportunities afforded manufacturing management. It's an important advantage in the "freedom of operation" of your plant. There are other "outside" costs that affect profit margins. That's why it is important for management to take advantage of scientific equipment replacement programs. These programs assist management in compiling and analyzing all factors pertinent to profitable machinery and equipment buying. They reveal the proper time to replace obsolete equipment.

For more information showing how other manufacturers are using their programs, write for the illustrated book. Write to any one of the companies in this group.

Rockford Insert Group

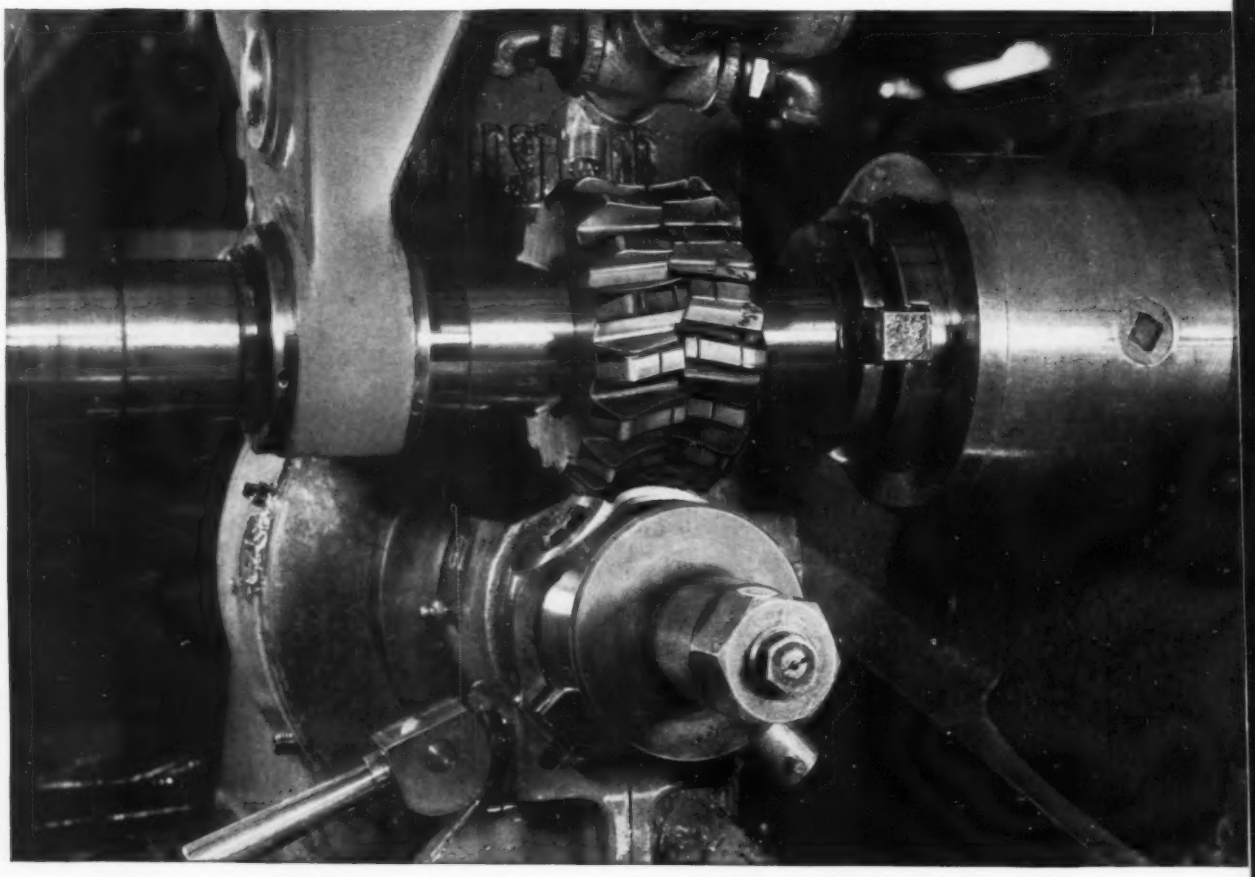
Keep gathering metal-working production ideas . . . be well informed when you replace machinery . . . .

January, 1958

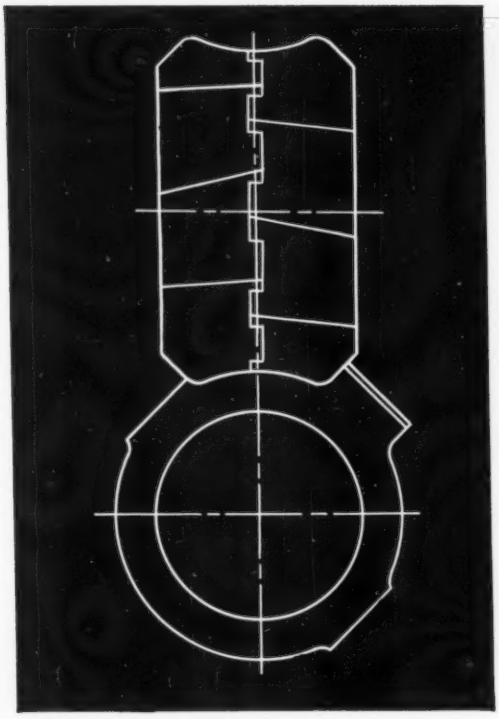
milling efficiency ✳
in tough steel calls for
expert cutter design

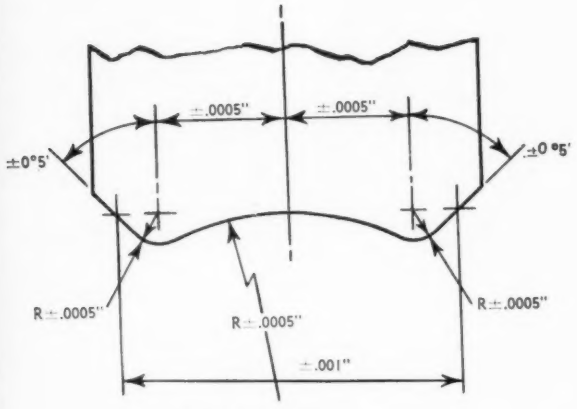
✳ **interlocking cutter with helical flutes in both directions provides positive cutting action in high alloy steel**

✳ **ground form-relieved cutter provides required accuracy for this aircraft part**



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**





Cutter Tolerances

Accurate milling of this high alloy steel part for Sundstrand Aviation requires a combination of expert cutter design and precision cutter manufacture. To accomplish this job, Barber-Colman engineers designed a ground, form-relieved, interlocking cutter which is 6" in diameter.

Since the material is tough alloy steel for an aircraft part, the cutter is made in two interlocking sections so that each half of the cutter can have helical flutes in opposite directions. This design provides positive axial rake on the angular portion of each half of the cutter, resulting in a shearing action as each side enters the cut. In addition, the alternate tooth design provides maximum overlap for smooth cutting action and fine finish. A free flow of chips is obtained by the combination of the opposite-hand helical flutes and the alternate teeth.

The form on this cutter is ground to hold the close tolerances required on the part. Each of the radii is held to a tolerance of ±.0005". The width of each half from the center of the radius to the center of the cutter is held to ±.0005", with an overall tolerance of ±.001" when the cutter sections are assembled. The form must fit the layout within .0005", and this tolerance is inspected to include the effect of axial and radial runout. Accurate tolerances such as these can be provided for your parts by Barber-Colman ground form-relieved cutters.

A fine finish is obtained using a feed of .980 inches per minute and a speed of 80 SFM. The tolerance for finish is 125 RMS. Approximately 200 inches of this tough steel are milled per sharpening.

Results like these are evidence that when you are milling tough materials requiring accuracy and finish, expert cutter design and manufacture are essential for cutting efficiency and good tool life. Consult Barber-Colman cutter engineers on your milling cutter requirements. Their long experience and manufacturing knowledge can save you production time and costs.

BARBER-COLMAN COMPANY

8 2 1 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

ENGINEERING DATA → PUNCHED TAPE FOR EACH PART

specifications:

248 Operations—
drilling, spotfacing, chamfering

Capacity—
parts up to 36″ O. D. x 30″ long

Spindle Capacity—
drill ¼″ to 1″ in steel,
3″ O.D. x No. 3 Morse Taper

Spindle Travel—
30″, with max. speed of 60 ipm.

Spindle Head—
hydraulic cylinder actuated,
300 ipm. rapid approach,
speeds—as selected by tape
feeds—4-feed rates between 0.5 and 11 ipm.

Rotary Table—
40″ O.D., 1½ HP motor

Tools—
13, quick-change type

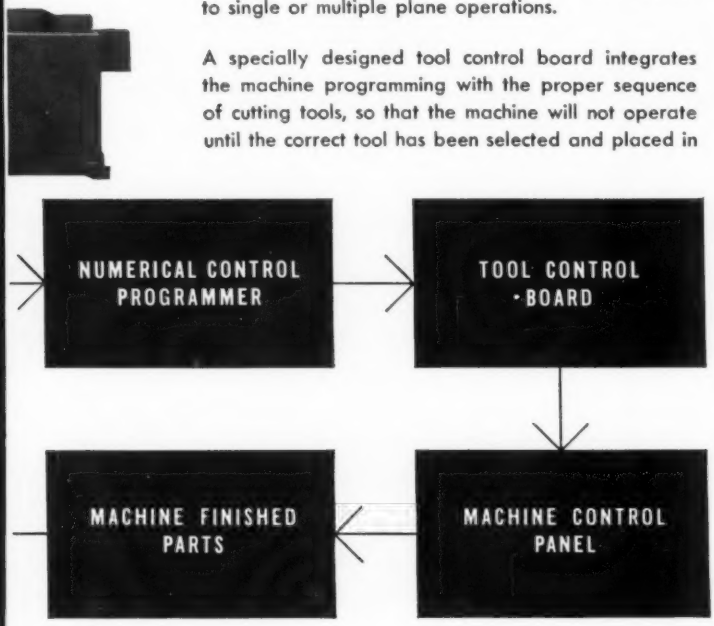
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

new BARNESDRIL machine
automatically programs 248 operations
on compressor housings

- **features numerical control by punched tape, unique tool control board**
- **reduces set-up, saves fixturing costs, assures accuracy**
- **solves high-volume, short-run production**

This new BarnesdriL programming machine automatically performs a preselected pattern of operations for machining gas turbine compressor housings, from information stored on standard, business-machine type, punched tape. The pattern is changed at will by substituting a different tape, and the pattern applies to single or multiple plane operations.

A specially designed tool control board integrates the machine programming with the proper sequence of cutting tools, so that the machine will not operate until the correct tool has been selected and placed in the machine, and all others returned after use to their proper places on the tool board. Tools are quick-change pre-set type, selected successively for drilling, boring, reaming, tapping, spotfacing and chamfering.



Information fed back from the machine's movements by means of selsyn motors maintains a constant check on the accuracy of positioning. In actual operation the machine cycles constantly within .003" for true positioning tolerance. Repeatability accuracy is within .001".

With program-type machining, BarnesdriL engineers provide automatically-selected spindle speeds in sequence, according to the best machining practice for the particular operation and kind of material. Feed rates are also programmed to meet the requirements of the part design and machining operation.

Flexibility in type, number and position of operations is obtained by substitution of separate tapes for individual parts to be machined. As a result substantial savings are realized in set-up time and fixturing costs. These are important advantages in high-output, short-run production. Also, with the flexibility inherent in program-machining, the need is eliminated for stock-piling parts.

your inquiries are invited!

BarnesdriL engineers invite your questions and inquiries in connection with production savings involved in program machining for high-output, short-run parts. Send parts or drawings for estimates, or request an engineer to call and discuss these problems in your plant!

50 th year

BARNES DRILL CO.

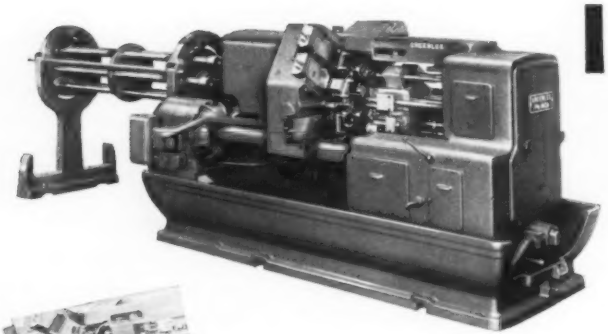
820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 3419 South Telegraph Road

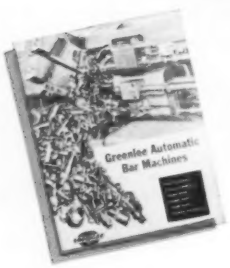
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

1. Simplified cross-slide camming
2. Interchangeable cross-slide tool holders
3. Quick-adjusting stroke mechanism
4. Rapid speed and feed changes
5. Wide-open, easily reached tooling area
6. Built-in threading feed and drive
7. Easily accessible main toolslide holders
8. Stationary type collets changed quickly

eight big reasons why you get *Fast Setups* on GREENLEE BAR AUTOMATICS

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . . . production . . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits





PRODUCTION MACHINERY
GREENLEE

4-SPINDLE...6-SPINDLE
SECOND-OPERATION
PNEUMATIC STOCK FEED

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FOR CATALOG
A-405

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO.
1861 Mason Avenue
Rockford, Illinois

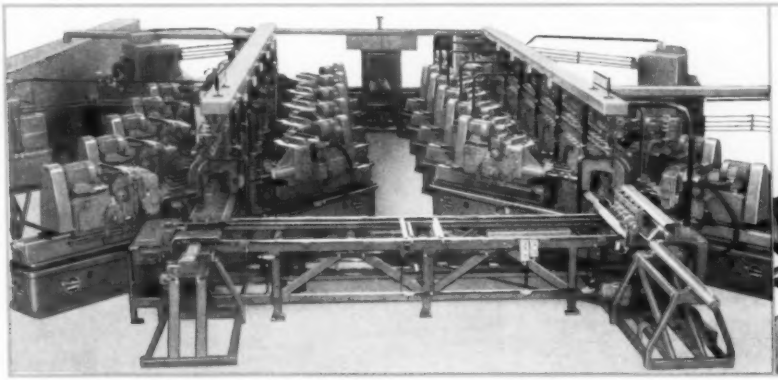
CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

HOW TO MACHINE Universal Joint Spiders AT LOWER COST

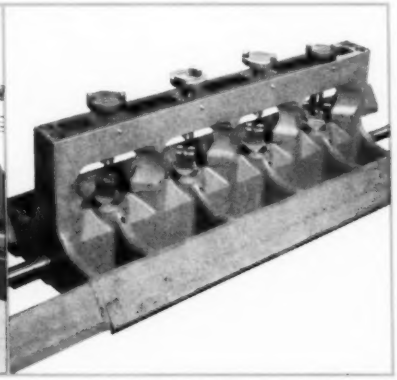
Positioning in Transfer Fixture Permits Straight-Through Operations, Conserves Space

Here is another example of how W. F. and John Barnes special machine engineering has effected a substantial reduction in production costs. By combining operations on two ends of four parts at each working station, universal joint spiders are drilled, chamfered, and hollow milled in a continuous cycle at a gross rate of 766 pieces per hour. Positioning and clamping of parts in pallet-type transfer fixtures permits straight-through operations without unclamping or re-positioning the workpieces. Rough broaching the forgings is the only preliminary operation.

A further refinement in the machine design includes power clamping of parts in fixture and automatic unclamping and unloading after machining operations are completed. Pallets are then returned to operator at the loading station. This same principle can be economically applied to a wide range of similar parts. Modifications in machine design can be made to suit individual production and cost requirements.



Barnes 17-Station Return Transfer-Type Machine processes universal joint spiders at gross production rate of 766 pieces per hour. Over-all floor space 2576 square feet.



View of pallet pusher-type transfer fixture equipped with clutch drive screws for automatic clamping and unclamping of 4 workpieces.

Builders of Better Machines Since 1872

W. F. & JOHN BARNES

ASK FOR AN ANALYSIS OF YOUR PRODUCTION METHODS

For assistance with any production machining job we suggest you call in Barnes engineers and ask them to assist you. Your production problems will be closely analyzed and given expert attention. All design and engineering as well as manufacturing facilities are coordinated at Barnes to help you solve problems quickly and efficiently.

Write for Free Brochure

Describes Barnes complete 6-point coordinated machine tool building facilities. Individual bulletins are also available describing and illustrating a wide variety of special drilling, boring, and tapping machines as well as special automation equipment.

W. F. & JOHN BARNES COMPANY

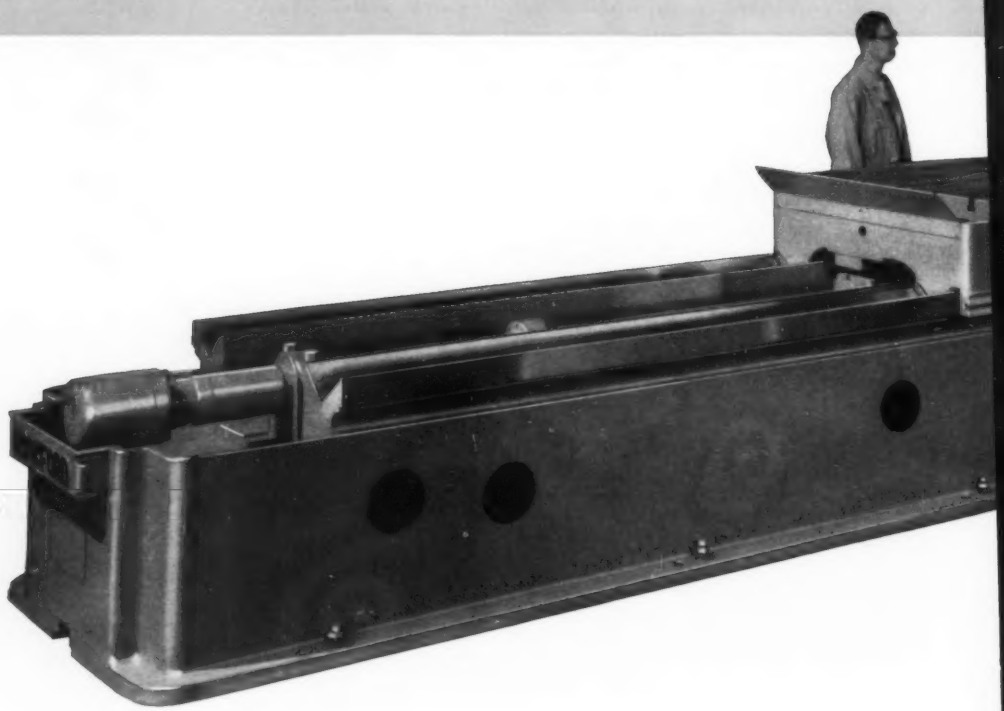
402 SOUTH WATER STREET • ROCKFORD, ILLINOIS

Multiple Spindle Drilling • Boring • Tapping Machines • Automatic Progress Thru Transfer-Type Machines

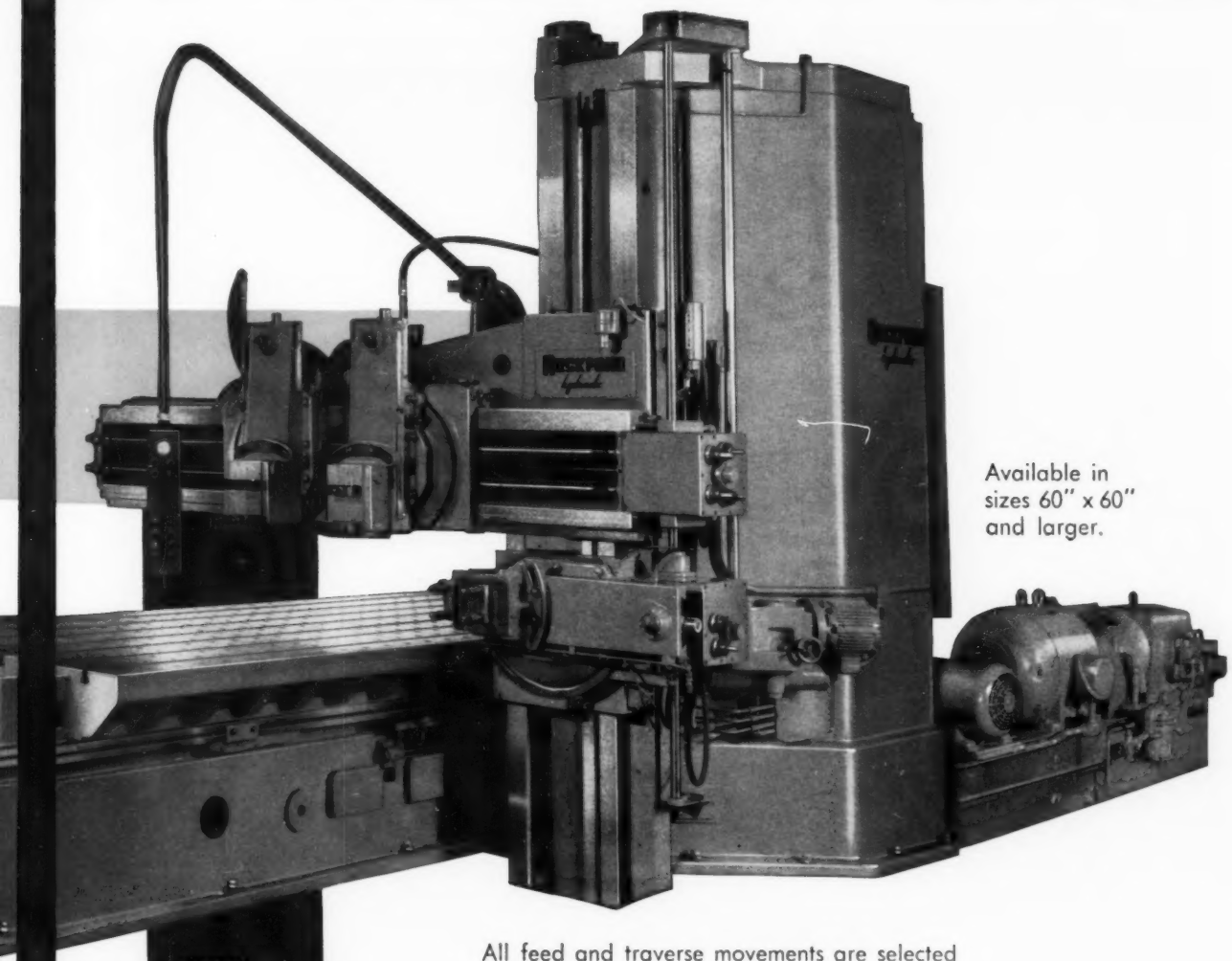
CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

2-speed traverse motors eliminate manual positioning in set-up on

new Rockford Hydraulic Planer



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**



Available in sizes 60" x 60" and larger.

complete pendant control speeds operation and set-up

All feed and traverse movements are selected and operated from the push button station of this new Rockford hydraulic planer. Two-speed traverse motors — high speed for approximate positioning, and slow speed for extremely close power positioning of rail and side heads — eliminate the need for manual positioning in setting-up for a job.

Extra-rugged construction affords use of most modern cutting tools and cutting techniques. The machine is equipped with the new high speed h3 triple circuit.

Get full details on the wide production flexibility of this new hydraulic planer from any Rockford Machine Tool Co. representative, or write directly to us.

h HYDRAULIC

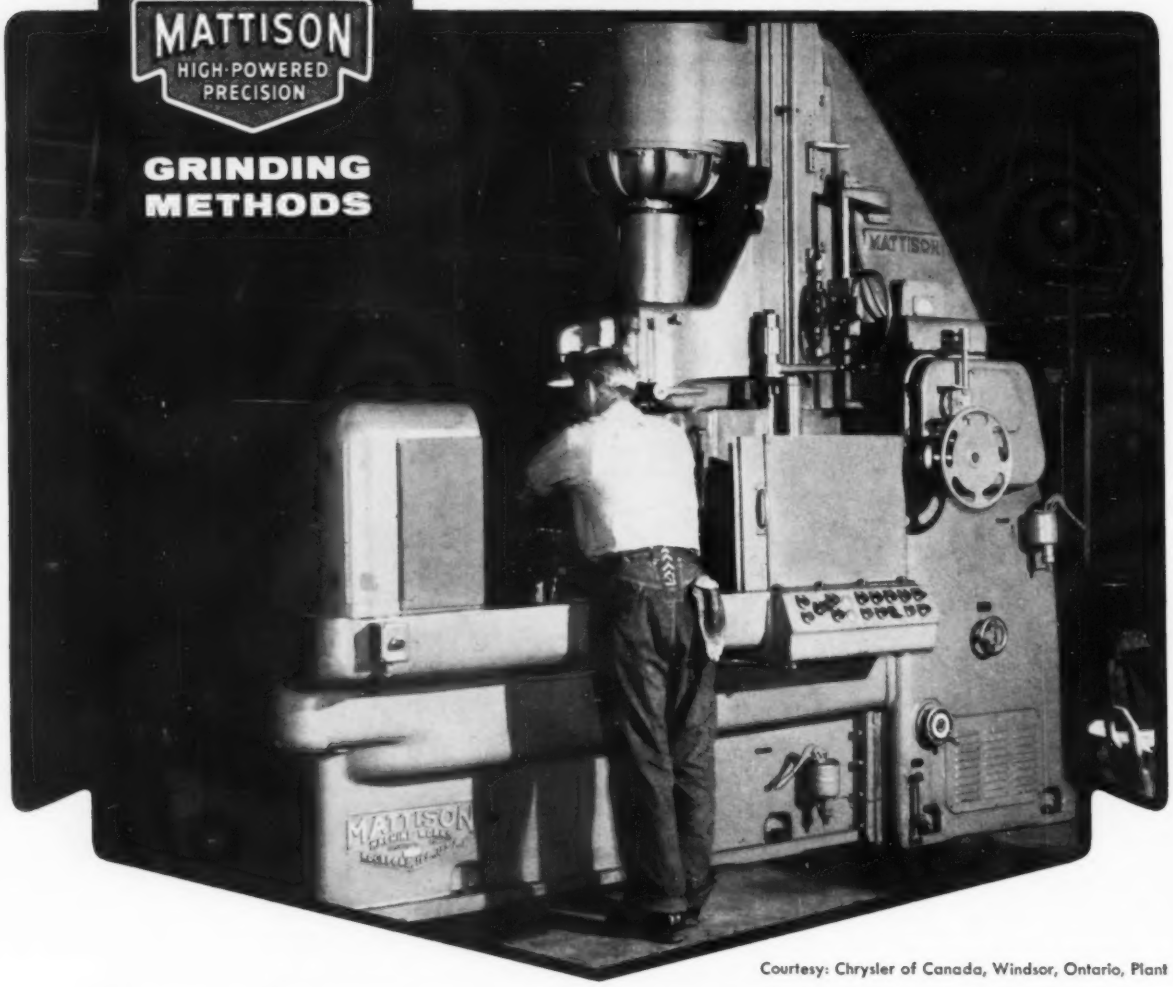
ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 36—CHAIN CASE COVERS

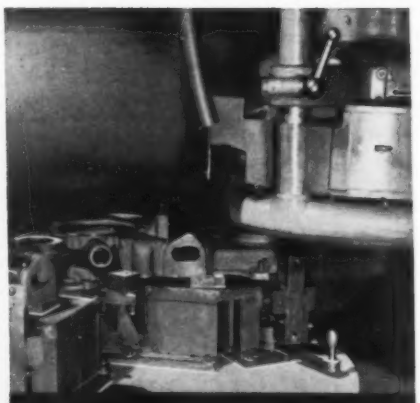
MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS



Courtesy: Chrysler of Canada, Windsor, Ontario, Plant

Three different surfaces on chain case covers ground at 13 per hour



In the Chrysler plant, the No. 36 removes up to ⅛ in. of stock while holding parallelism to .001 in. and accuracy to .002 in.

Power and rigidity of the Mattison No. 36 Vertical Rotary Surface Grinder pay off on this heavy stock-removal job at Chrysler of Canada's new Windsor, Ontario, motor plant. Three faces of heavy cast iron chain cases are ground in one setup . . . achieving a production rate of 13 cases per hour, each ground on three different surfaces.

The table passes the cases under the wheel at the rate of 30 rpm. Wheel speed is 900 rpm and downfeed is .060 in. per minute. Automatic sizer checks each piece as it leaves the wheel and corrects feed accordingly.

Quality was one of the deciding factors in the selection of machinery for the new Chrysler plant. Like many other manufacturers, Chrysler has found the No. 36 Vertical Rotary's integral column-and-base construction, extra power, and exclusive functional design enable it to use modern, improved grinding wheels effectively . . . and profitably. For full details ask for Bulletin No. 146-4RM.

IF IT'S A FLAT SURFACE THERE IS A MATTISON TO GRIND IT

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 37—TIMING GEAR HOUSINGS

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS

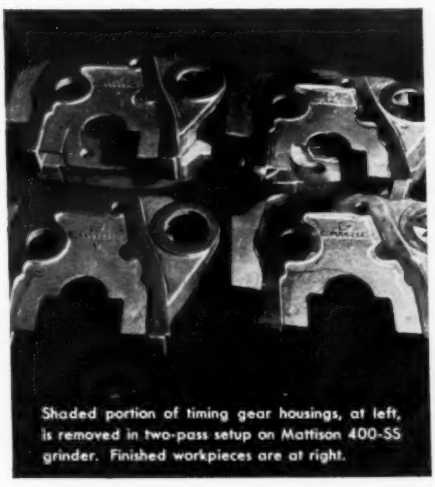
Courtesy: Allis-Chalmers Mfg. Co.

Bigger loads, faster setup on surface grinder doubles production of parts formerly milled!

Production was boosted from 5 to 12 parts per hour by switching this job to a Mattison No. "400-SS" Vertical Spindle Reciprocating Table Surface Grinder. The workpiece is a diesel engine timing gear housing that is first rough-ground to within .010 inch on both sides and then finish-ground on the same machine. Flatness and dimensional tolerances are easily maintained within commercial limits.

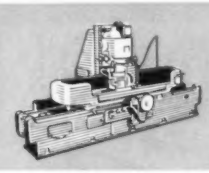
Practical elimination of setup time is a big item in getting this increased production. Most parts have only to be laid flat on the magnetic table, fixtures are not needed in most cases. Seven castings, like those shown, can be finished at one time.

An extra-long and heavy column, rigidly fastened to the base, and a 60, 75, or 100 hp spindle motor are features which speed metal removal and increase accuracy on the Mattison 400 Series Vertical Spindle Surface Grinder. Arrange for a test grind on your parts in the Mattison Methods Laboratory.



Shaded portion of timing gear housings, at left, is removed in two-pass setup on Mattison 400-SS grinder. Finished workpieces are at right.

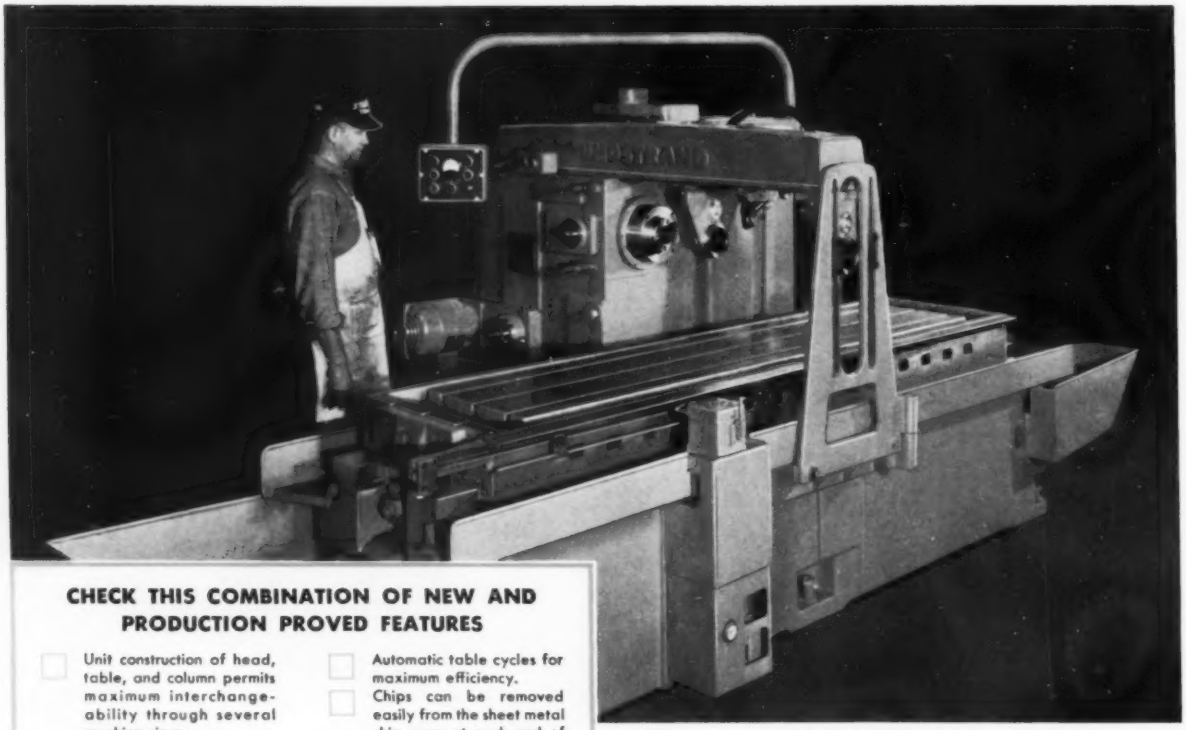
MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.



HIGH-POWERED
PRECISION
SURFACE
GRINDERS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

New SUNDSTRAND C-MODEL RIGIDMILS COVER A WIDE RANGE OF JOBS



MODEL-C4 RIGIDMIL (illustrated above)

CHECK THIS COMBINATION OF NEW AND PRODUCTION PROVED FEATURES

- ☐ Unit construction of head, table, and column permits maximum interchangeability through several machine sizes.
- ☐ 100 to 1 ratio between high and low feed rate in mechanical drive for table feed screw. Standard feed ranges available are: ¾" to 75" or 1½" to 150" per minute.
- ☐ Climb or conventional milling can be performed separately or in combination.
- ☐ Screw feed to table.
- ☐ Square type table ways surfaced with wear resistant, nonscoring material.
- ☐ Automatic lubrication to all moving parts.
- ☐ Unusually heavy spindle with precision type bearings.
- ☐ Automatic table cycles for maximum efficiency.
- ☐ Chips can be removed easily from the sheet metal chip pans at each end of machine.
- ☐ Adjustable dwell mechanism for one or both ends of table.
- ☐ Ball bearing screws can be provided for numerically controlled or electronic tracer controlled machines.*
- ☐ Second table feed rate for one or both ends.*
- ☐ Vertical power movement to head.*
- ☐ Vertical feed and rapid traverse to head.*
- ☐ Chip paddles for removal of chips to chip pan.*

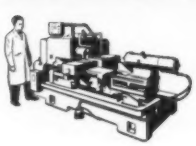
* *Optional at extra cost.*

Now — for the first time — you can get the right combination of table sizes, strokes, spindle speeds, horsepower, controls, etc., for your job in the new line of Sundstrand C-Model Rigidmil milling machines. Sundstrand's unit construction means head, table, and column are interchangeable through several sizes, enabling you to customize your installation when required.

This interchangeability is only one advantage, and it's a long way from being the entire story — the line was designed with the needs of the production man in mind as the partial checklist (at left) shows. Every Sundstrand C-Model Rigidmil can be set up quickly and easily to handle a wide range of work. It can be hand controlled by push buttons for single job setups, or controlled automatically by dogs on

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

SELECT YOUR C-MODEL RIGIDMIL FROM THESE SIZES AND COMBINATIONS

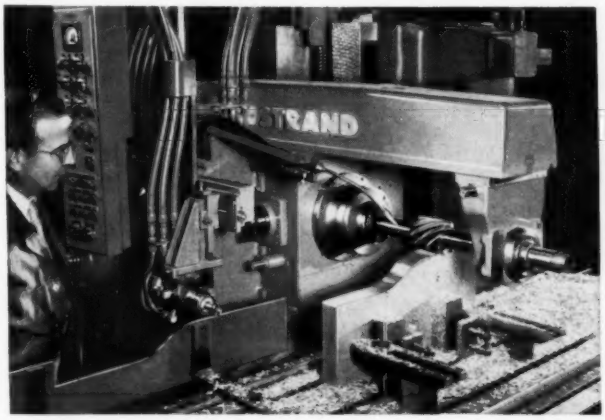
MODEL	TABLE STROKE (feet)	TABLE WIDTH (inches)	MOTOR HP	SPINDLE SPEED RANGE (rpm) LOW	MEDIUM	HIGH
C2	3, 4, 5, 6, 8, 10	14, 18	7.5, 10, 15	27 to 806	38 to 1142	54 to 1606
C3	3, 4, 5, 6, 8, 10, 12, 14	14, 18, 24, 30, 38	10, 15, 20	18 to 450	27 to 675	47 to 1180
C4	3, 4, 5, 6, 8, 10, 12, 14	18, 24, 30, 38	20, 25, 30	14 to 356	21 to 537	39 to 980
C5	4, 5, 6, 8, 10, 12, 14	24, 30, 38	40, 50, 60	11 to 261	18 to 445	28 to 697
C6	8, 10, 12, 14	30, 38	60, 75	10 to 196	15 to 295	

NOTE: Duplex models available in same sizes.

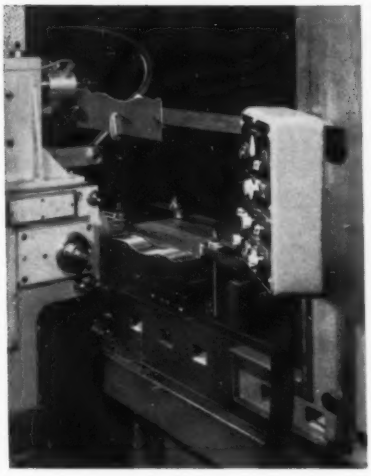
the front of the machine for a wide variety of table cycles in production milling.

For example, climb or conventional milling can be done separately or in combination on C-Model Rigidmils. A backlash eliminator, added to the table screw, is standard on machines in this line, providing the positive feed necessary for climb milling.

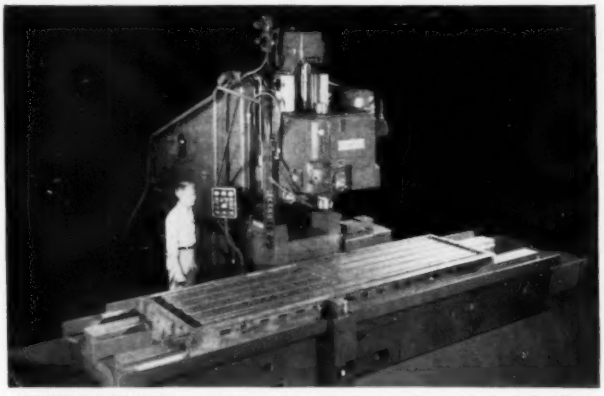
Duplex Rigidmils for machining parts with opposed faces are available throughout the entire range of sizes in the C-Model Rigidmils. Two basic types of tracer Rigidmils also enables Sundstrand "Engineered Production" service to provide you with the most practical milling method suited to your production. Tracer milling units for cutting either aluminum and non-ferrous metals, or steel are available in all models of machines.



TRACER MILLING IN ALUMINUM . . . C-Model Rigidmils can be provided with a hydraulic tracer unit for the milling of aluminum and non-ferrous metals. Exceptional flexibility is possible with this unit as the tracer system can be disconnected and the machine used for conventional face or arbor milling.



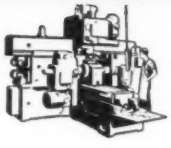
TRACER MILLING IN STEEL . . . The new C-Model Rigidmils can be provided with an electronic tracing system using a magnetic tracer head for tracer milling of steel parts. Feed rates and directions cause the tracer stylus to follow a template at an essentially constant deflection and speed.

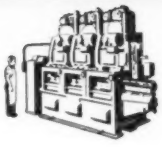


ADJUSTABLE COLUMNS can be provided for either horizontal or vertical spindle (illustrated) C-Model Rigidmils. Machines are available with either manual, or power adjustment or power feed to the cross movement of the columns . . . making possible greater flexibility and more efficient milling over a wider range of part sizes.

Write today for Bulletin 687 describing the complete line of Sundstrand C-Model Rigidmils.

TRIPLEX RIGIDMILS | SPECIAL MACHINES

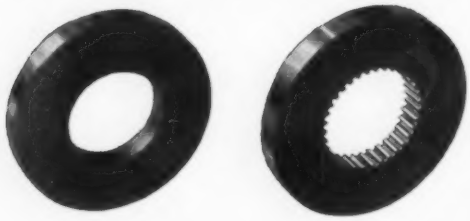


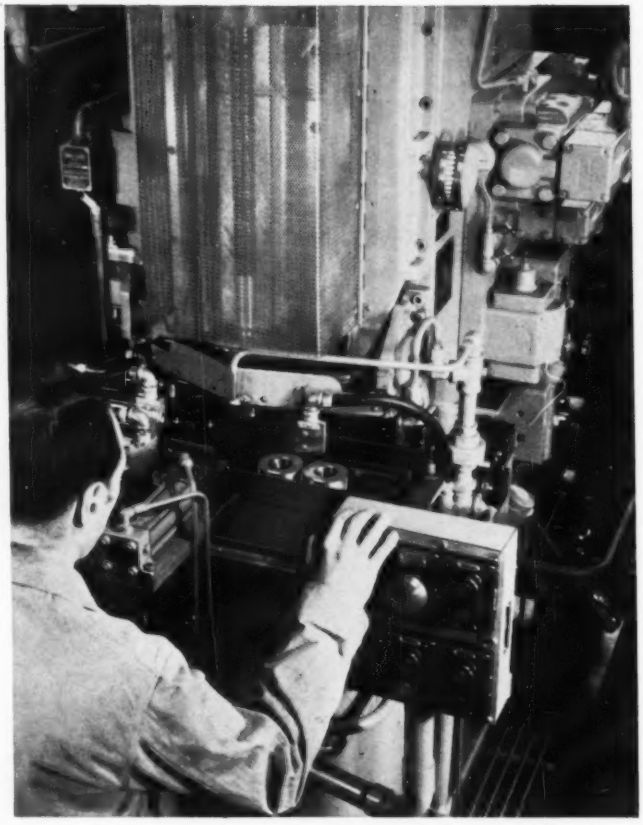


SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Splines and I. D. Broached in 300 Pump Gears per Hour!...





This American 3-Way Hydraulic Broaching machine with automatic loading and unloading, broaches the I. D. and 35 involute splines in 300 automotive pump gear parts per hour. Maximum accuracy is assured because the broach retreiver follows the broach down a principal portion of the broaching stroke.

After the cycle is started, parts are automatically taken from conveyor and placed into broaching position. After broaching, parts are ejected from fixture and returned to the conveyor line.

The increased production and improved accuracy are typical of American's "Engineered Production" as applied to the three elements necessary for the most practical broaching solution to any broaching problem. This method effectively adds years of design and production engineering experience, unavailable at any price, to your staff at no extra cost.

It takes All 3 for peak broaching performance

1 *Proper Broach Tool Design* — This logical first step in solving a broaching problem requires consideration of stock removal, length and width of cut, finish, tolerances, etc., so broach and machine operate as a team.

2 *Specifying the Right Machine* — Production rate required, length and speed of stroke, floor space, and relationship with other production machinery were all considered before choosing the American 3-Way for this job.

3 *Efficient Fixturing*—This vital third link in the production chain enables production schedules to be met even with inexperienced operators because skills are "built in."

SUNDSTRAND

American
BROACH & MACHINE DIVISION
SUNDSTRAND MACHINE TOOL CO.
ANN ARBOR, MICHIGAN

Broaching Tools

Three Way

Single Ram

Horizontal

Duplex Ram

Presses

Write for Bulletin A622 "Practical Broaching Methods."

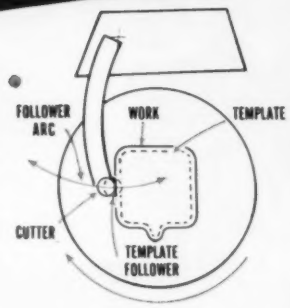
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

when you have parts of aluminum or other nonferrous metals . . .

that must be side, face or contour milled to look like this . . .

You can do the job better, far faster and at much less cost with an Onsrud **ROTARY FEED HIGH SPEED MILLING MACHINE**

Guide roller mounted on pivoted arm follows template, moves to any point of follower arc to vary cutter head position as required, as table rotates to feed work through complete milling cycle.

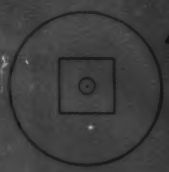


Here is one of several Onsrud Rotary Feed Milling Machine models . . . a design type that has become the most versatile and productive in metal milling. The kinds of production parts that can be milled to advantage are almost endless in number . . . wherever the operation involves straight line or contour side milling or horizontal top-edge milling. The A-50AE machine shown here has a capacity for work up to 40" diameter. A high speed milling head with Onsrud two speed 7½/3¾ HP, 3600/1800 RPM air cooled motor gives proper cutter speed for fine finish and rapid feed. Other models supplied to fit work requirements as needed.

Write for Information

Let us tell you how Onsrud Rotary Feed Milling Machines can lower your production costs . . . in aluminum and related nonferrous milling. We'll also be glad to give you information on all other Onsrud milling machines for every type of production milling. Your inquiry is cordially invited.

WORK SET-UPS LIKE THESE . . . PART OF THE PRODUCTION ADVANTAGES OF ONSRUD ROTARY FEED MILLING



ALL FOUR SIDES IN ONE SET-UP

Work held by pneumatic center clamp, for milling completely around the part if desired.

CONTINUOUS PRODUCTION

Work fixture built with two, three or four (or more) stations for continuous feed of work to cutter. Operator merely loads and unloads without production time loss.

ONSRUD
MACHINE WORKS, INC.
MACHINE TOOL DIVISION
7716 LEHIGH AVENUE (SUBURB OF CHICAGO) MILES 31, ILLINOIS

Onsrud® High Speed **MILLING MACHINES** for Aluminum and Related Nonferrous Metal Milling

For doing things *better* by doing things *differently!*

For more information fill in page number on Inquiry Card, on page 227

STRIPPIT *tooling versatility*

keeps presses working, not waiting!

Nothing to mount on the ram, nothing to align or adjust — just place your Strippit setup in the press and start the run.

That's how Strippit versatility pays off. Any good bench man can mount these independent self-contained punching and notching units in any template pattern within press capacity. New Strippit setups can be kept ready for the press, virtually eliminating down-time.

For flatwork, extrusions, structurals from the smallest gauge to 3/4" mild steel, Strippit gives you these extra advantages:

• The effect of quick-change dies without die-making or die-spotting • Speed over drilling — plus no deburring • Units re-usable over and over • Readily removable punches and dies • Ease, accuracy of template mounting — pilot pin centered on punch • Each unit complete — permanently aligned, fully guided, self-stripping.

For unlimited feeding of work, Strippit Type CD and JD (heavy-duty) Punch and Die Assemblies are readily template-mounted to press ram and bed in any desired pattern.

Write today for all details and a demonstration by a Strippit mobile unit at your plant.

Special tools made up to your specifications.
Warehouse facilities in Chicago and Los Angeles.

UNIT OF TEXTRON INDUSTRIES INC. HOUDAILLE

WALES STRIPPIT COMPANY
203 Buell Road, Akron, New York

One of a complete line of Strippit vertical and horizontal hole punching units in capacities from the lightest material to ¾" mild steel. Wide choice of die heights, shut heights and throat depths.

Also, 90-degree Corner Notching Units in 3" x 3" and 5" x 5" sizes, plus V, Radii and many special shape notching units. Capacities to ⅛" in mild steel.

Manufactured in Canada by Strippit Tool & Machine Limited, Brampton, Ont.

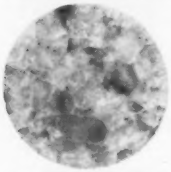
DoALL ACQUIRES WORLD'S FINEST SOURCE OF BLACK GRANITE-*DIORITE* FOR SURFACE PLATES

NO SOFT SPOTS

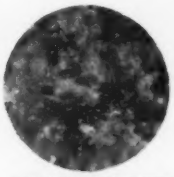
WON'T SCRATCH

BLACK GRANITE

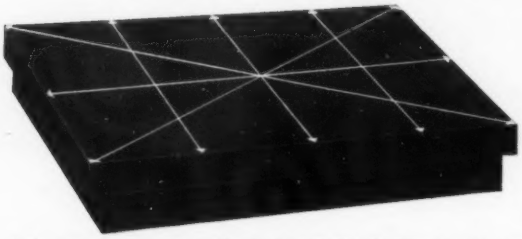
So dense and smooth a scriber can't find soft spots nor will it scratch sensitive acetate. DoALL Black Granite-Diorite is the superior material in all ways. You can see its denser grain structure, compared with pink and gray.



PINK GRANITE



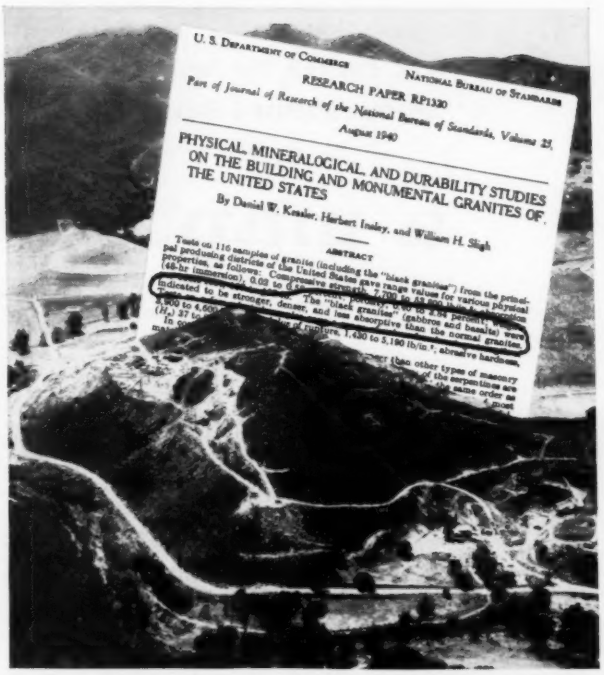
GRAY GRANITE



A better accuracy standard. DoALL Black Granite-Diorite surface plates are specified from an over-*all mean plane*, not per square foot area.

10-DAY FREE TRIAL OFFER!

Prove for yourself in your own plant the superiority of Black Granite surface plates. We will deliver your choice from these four sizes: 8″ x 12″, 12″ x 18″, 18″ x 24″ and 24″ x 36″.


U. S. Department of Commerce — National Bureau of Standards

RESEARCH PAPER RP1320

Part of Journal of Research of the National Bureau of Standards, Volume 25, August 1940

PHYSICAL, MINERALOGICAL, AND DURABILITY STUDIES ON THE BUILDING AND MONUMENTAL GRANITES OF THE UNITED STATES

By Daniel W. Kessler, Herbert Insley, and William H. Sligh

ABSTRACT

Home of DoALL Black Granite-Diorite is this Quarry No. 115 near Escondido, California, which the National Bureau of Standards lists in its research paper R.P. 1320 and Fed. Spec. 666-P-463 as the source of finest Black Granite-Diorite.

SEE THE DIFFERENCE IN YOUR OWN SHOP

While granites in general are usually selected as surface plate material over cast iron, much confusion exists as to *which* granite *is the best*.

Different types of granite have varying degrees of soft spots or lack toughness and resistance to wear. Others do not have the density necessary for greatest strength and least porosity, and some types cannot be properly lapped to a fine finish. All of these factors lessen the degree of accuracy obtainable. In its search for better granites, the National Bureau of Standards Research Paper RP-1320 states: "The Black Granites (gabbros and basalts) were indicated to be stronger, denser and less absorptive than the normal granites."

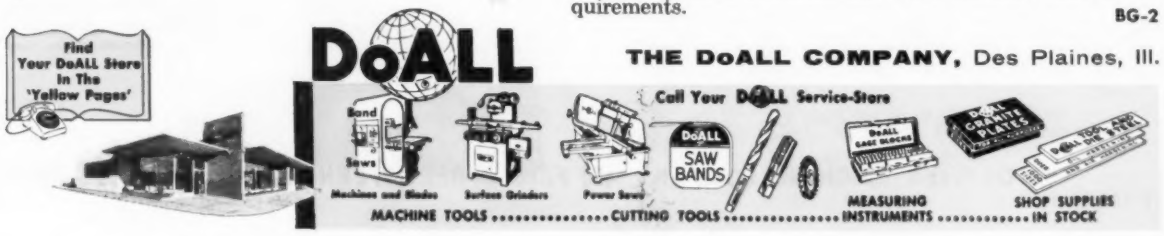
By obtaining the best in granites, DoALL can impart its years of gaging experience to the manufacture of the finest in surface plates.

Take advantage of our *Free Trial* offer to find out why DoALL Black Granite-Diorite is preferred over all other surface plate material.

Call your DoALL Gage Specialist now; he will give you expert assistance in determining your accuracy and size requirements.

BG-2

THE DoALL COMPANY, Des Plaines, Ill.



T. R. DREYER, Vice President—Brooklyn Manufacturing
American Machine & Foundry Company

a man who came to Fair Street

"The JIGMIL Technique enabled us to establish new manufacturing methods which provided greater accuracy, improvement in our product, substantial reductions in assembly time, and major reductions in machine time, all without investment in jigs."

"We accepted an invitation to go to Fair Street and there saw the JIGMIL Technique in operation doing boring and milling to high degrees of accuracy and economy. The potential savings in our own plant became apparent and we developed a JIGMIL program which resulted in new economies in our manufacturing methods. The inherent accuracy, power and rigidity of this machine tool, combined with its automatic positioning and ease of operation are especially adaptable to precision boring and milling operations on side frames and gear boxes. In addition to the noteworthy savings in boring time and reduced tooling cost, we gained the advantage of milling in the same setting at a minimum of cost."

T. R. DREYER

DEVLIEG MACHINE COMPANY, 450 FAIR STREET, FERNDALE • DETROIT 20,

SOME OF OUR JIGMIL USERS

Aerojet-General Corp.
American Can Co.
Avco Manufacturing Corp.
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Boyar-Schultz Corp.
Carrier Corp.
Clark Equipment Co.
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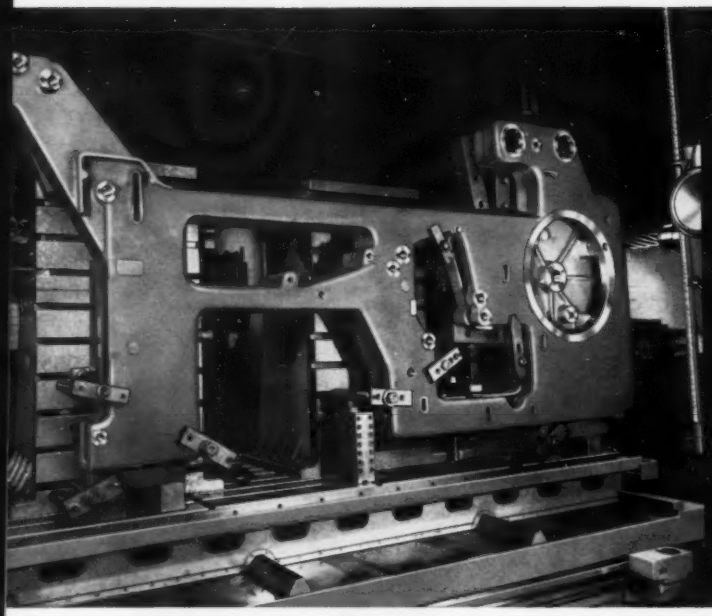


A FEW PROVEN ADVANTAGES OF THE JIGMIL TECHNIQUE—

- Eliminates cost of expensive jigs and production delays resulting from their manufacture.
- Simplifies tooling.
- Employs automatic functions to reduce factors of human error even in close tolerance work.
- Makes possible greater flexibility of product design.
- Improves end product by permitting interchangeable assembly of parts without hand fitting.
- Increases production and product accuracy.

ACCURACY IS AN ECONOMY!

A TYPICAL EXAMPLE OF JIGMIL VERSATILITY

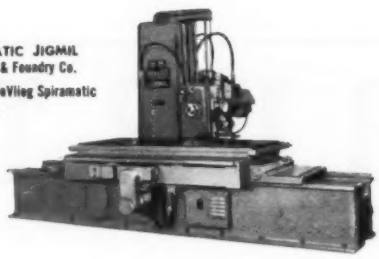
AMF uses the JIGMIL Technique for machining a multitude of components for their cigarette making machines, bread-wrapping machines, automatic pin setters, cigar making machines and many others. Illustrated is a pair of bread-wrapper side frames set against angle blocks on a Model 4B-96 SPIRAMATIC JIGMIL. All boring and side milling operations were done on the JIGMIL in one setup. Previous time on conventional boring and milling machines was 10 hours per part. Time on the JIGMIL is 3 hours per part.

The Glenn L. Martin Co.
Michigan Tool Co.
North American Aviation, Inc.
Northrop Aircraft, Inc.
Otis Elevator Co.
Pratt & Whitney Aircraft Division, United Aircraft Corp.
Solar Aircraft Co.
Speco Division, Kelsey-Hayes Co.
Thompson Products, Inc.
United Shoe Machinery Corp.
Western Electric Co., Inc.
Yale and Towne Manufacturing Co.
York Corp.

WILL YOU BE THE NEXT TO VISIT FAIR STREET

Model 4B-96 SPIRAMATIC JIGMIL as used by American Machine & Foundry Co.

For complete information on DeVlieg Spiramatic Jigmils, send for new catalog.



MICHIGAN

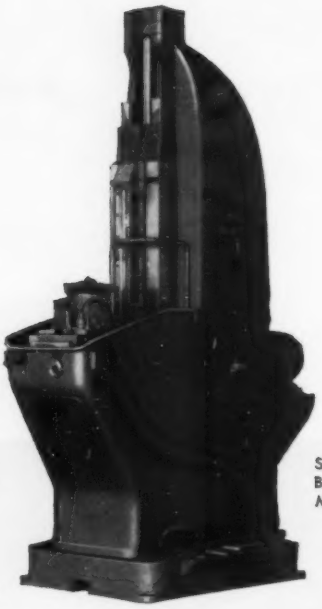
DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES IN PRECISE LOCATIONS

FOOTBURT

a faster
MORE ECONOMICAL
machine operation



Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

Footburt Surface Broaching may be the answer to your problem of faster machining. Many jobs that were slow and expensive when handled by conventional machining methods are now being produced by Surface Broaching. Production in most cases is as fast as the speed at which parts can be loaded. Yet cutting speeds are so low that the cost of tool maintenance shows great savings. Exceptional finish can be maintained. We will gladly discuss your machining problems with you.

THE FOOTE-BURT COMPANY

Cleveland 8, Ohio Detroit Office: 24632 Northwestern Hwy., Detroit 35, Mich.

Write for Circulars No. 503 and 509

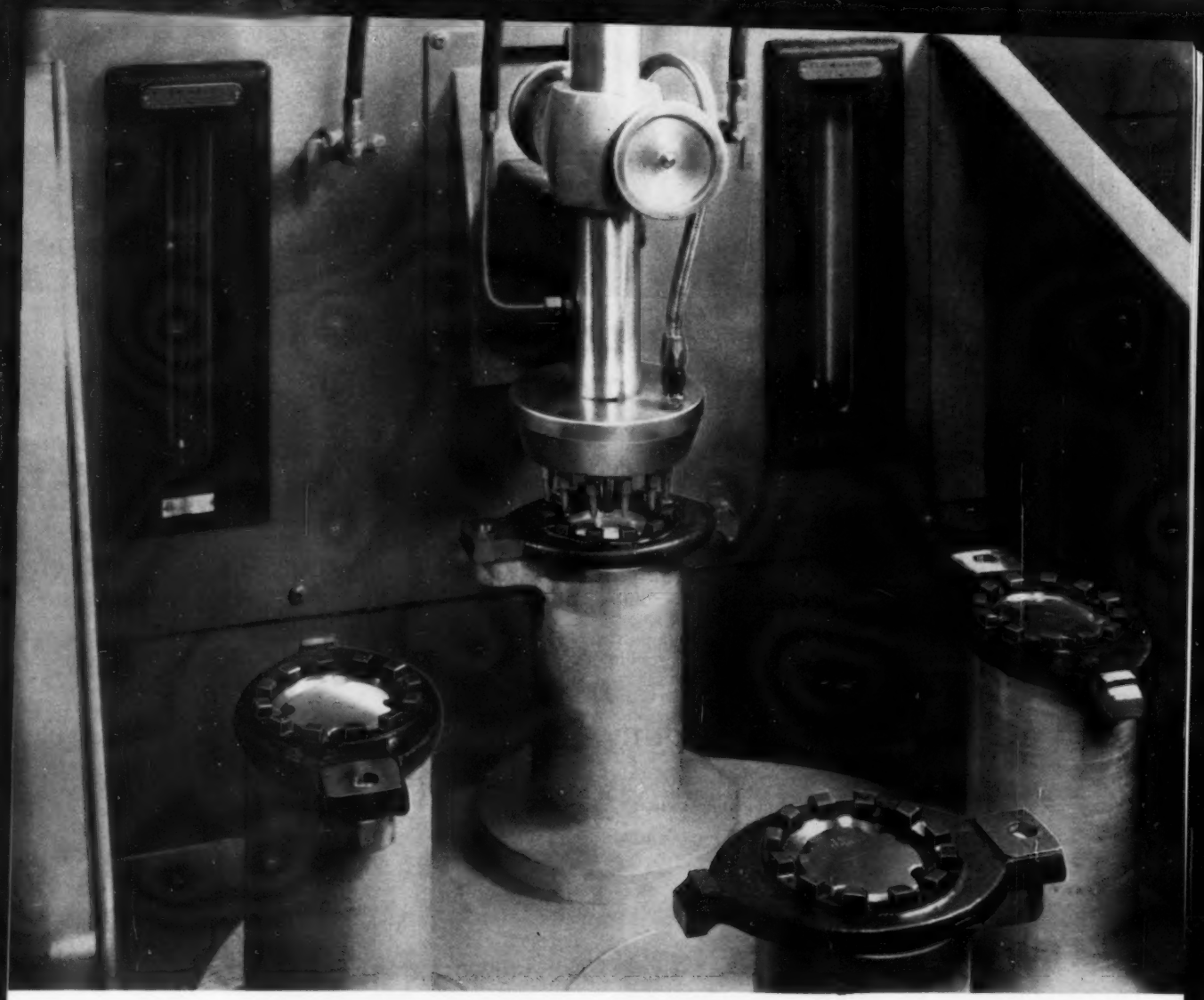
Duplex Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

Continuous Type Broaching Machine. Made in 5 Sizes.

FOOTBURT

PIONEERS IN SURFACE BROACHING

For more information fill in page number on Inquiry Card, on page 227



Now...*controlled hardening* of wearing surfaces

With these new Gleason machines you can make metal surfaces on couplings, splines, and other parts more wear-resistant by surface hardening.

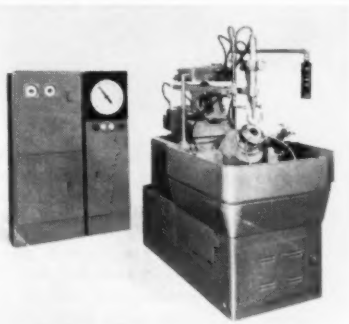
In the setup shown, the machine heats all twelve teeth of a coupling at once with a twelve-tip oxyacetylene burner. Indexing of work to the burners is automatically controlled.

A cam-controlled burner motion provides an oscillating movement of the burner tips to assure uniform penetration of the heating. This oscillating action in conjunction with electric timers controls the depth of hardness.

There is no measurable distortion because only the coupling teeth are heated and each tooth is heated uniformly on both sides, and the hardness is limited to the wearing surfaces. The life of the part is greatly increased.

You can set up the machine for small as well as volume production of parts up to 12″ diameter. Both ways, the machine is completely automatic except for loading.

This is one of a series of Gleason machines for hardening metal parts including bevel and hypoid gears and spur and helical gears. For additional information write for our bulletin. *Complete coupling is surface-hardened* in a single pass on the Gleason No. 108 Surface Hardening Machine.



Gleason No. 1 Gear Surface Hardener with electronic control unit. Accommodates bevel gears up to 24″ pitch diameter, spur and helical gears up to 30″, internal gears up to 24″ outside diameter.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

3 WAYS YOU CAN KEEP

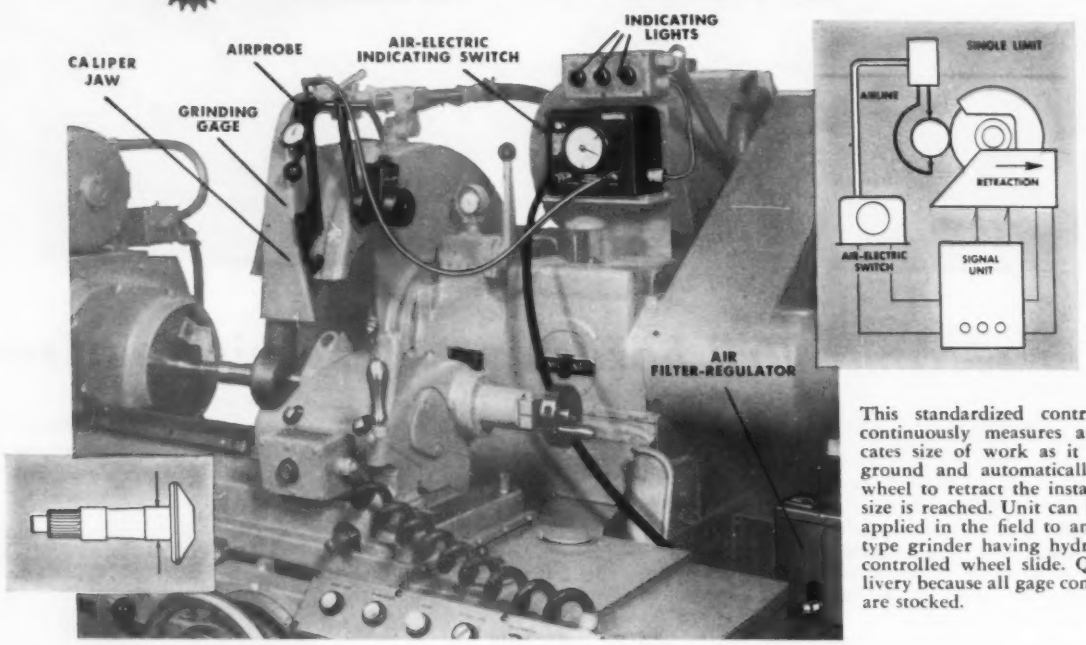
A BETTER PRODUCT . . . AT LESS COST . . . THROUGH ADVANCED GAGING . . . . . .

Profit margins aren't getting any better . . . just the opposite. With buying appetites fairly well satisfied, it's no longer a matter of "getting the stuff out". The problem now is making it *better at lower cost.* You certainly don't plan to let competition catch up to you. So consider these ways of improving product quality and, at the same time, cutting down on the cost per piece. Advanced gaging — by FEDERAL — can do it. The gaging ideas are proven profit makers. The gages, far from being monsters of automation, are compact, standardized units, realistically designed to provide automatic control or inspection, or both, where it does the most good and at a price that practically *every* manufacturer can afford. And they have reliability . . . the most important single feature of FEDERAL Gaging.

Whether you're big or small in terms of production, ***at least one of these gaging arrangements can pay off for you.*** *It's the truth. Ask us to prove it. Write:*

FEDERAL PRODUCTS CORPORATION
8111 Eddy Street, Providence 1, R. I.

1 AUTOMATIC CONTROL OF FINISH SIZE



This standardized control gage continuously measures and indicates size of work as it is being ground and automatically causes wheel to retract the instant finish size is reached. Unit can be easily applied in the field to any center type grinder having hydraulically controlled wheel slide. Quick delivery because all gage components are stocked.

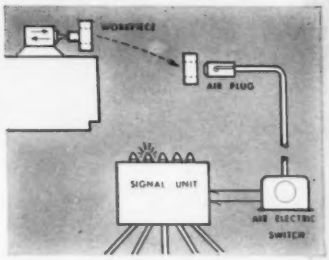
BENEFITS: *Reduces cost of operation — permits one operator to handle two, possibly three grinders performing the same or different operations. In this way gages pay for themselves within a few months.*

Improves quality — even if you have only one grinder, gage is a profit-maker because it eliminates error due to operator inattention or fatigue and also eliminates cost of later inspection. Gage never tires, is accurate to .0001" or better, is easily adjustable to control different sizes of work. Its Air-Electric system overlooks minor workpiece surface irregularities which confuse size readings of other gages.

VARIATIONS: *Similar FEDERAL Gages are available through machine tool manufacturers to also change wheel feed rate to dwell grind . . . or to control dressing cycle and finish size on I.D. grinders. When specifying machine tool requirements be sure to include* FEDERAL *Gaging.* FEDERAL *maintains close engineering alliance with all leading machine tool manufacturers.*

AHEAD OF COMPETITION

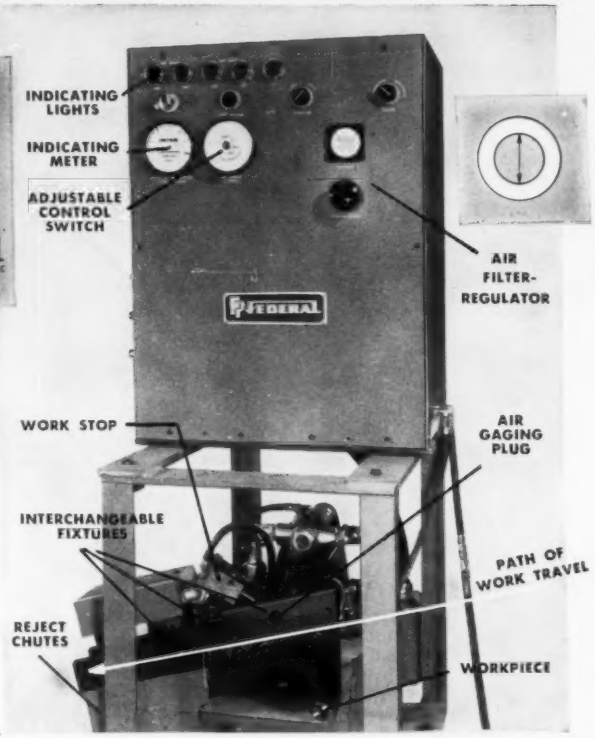
2 AUTOMATIC 100% INSPECTION

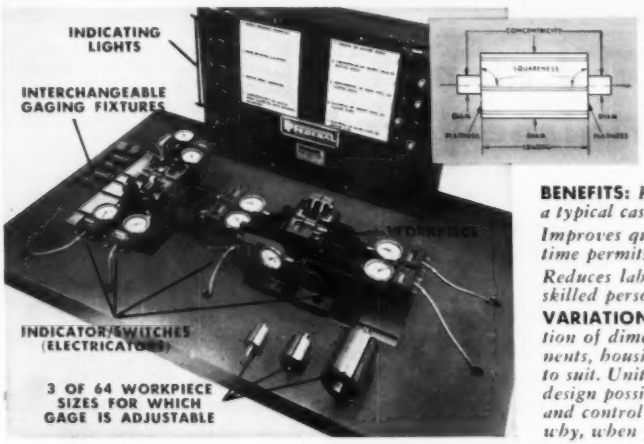


This standardized "post-process" gage inspects every part as it is discharged from the machine and sorts work into "good", "near-over", "near-under" plus "salvage" and "scrap", indicating the size of each piece as it is gaged. Operator, watching large indicating lights, can compensate machine for drift and piece-to-piece variation *before any scrap parts are produced.* Unit can be applied to any type I.D. or O.D. grinder, lathe, boring machine or screw machine. Gaging fixtures can be made interchangeable to handle various work sizes.

BENEFITS: *Lower cost per part. Gage virtually eliminates scrap by showing trend before tolerance limits are reached. Eliminates inspection errors — gage has 99.8% reliability or better as compared to about 92% for operator inspection and about 85% for inspection by other personnel.*

VARIATIONS: FEDERAL *Gages of similar type are available through machine tool manufacturers to also provide automatic compensation of the machine, either proportionally or by increments, so that drift is corrected without need for operator attention. Moral: To get the maximum return for your investment, be sure to specify* FEDERAL *Gaging when you're buying machine tools.*





3 SEMI-AUTOMATIC, MULTIPLE DIMENSION MEASUREMENT

Ideal for small and medium production manufacturers, this gage checks nine dimensions in two stations and is adjustable for 64 different sizes! Work is loaded and disposed of manually. Lights show "good", "over" and "under". Units like this one have paid for themselves in well under six months.

BENEFITS: *Reduces non-productive costs — inspection time per part, in a typical case, is reduced 75%.*

Improves quality level. Inspection error is eliminated. Greatly reduced time permits profitable 100% inspection instead of sampling.

Reduces labor cost. Inspection can be performed satisfactorily by less skilled personnel.

VARIATIONS: *Unit can be designed to provide virtually any combination of dimensional measurements. Sensing elements, electrical components, housing and base are standardized. Other components designed to suit. Unit can incorporate semi-automatic disposal. Number of other design possibilities all the way up to a completely automated inspection and control gage. In every design the emphasis is on reliability. That's why, when you buy* FEDERAL *Gaging, you buy results.*

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

From a Sound Blank Comes a Sound Finished Product

One of the best ways to insure top quality in finished circular products is to insist on sound, reliable blanks. You have this assurance when your specifications call for Bethlehem blanks, which are unsurpassed anywhere.

These sturdy steel pieces are made in a two-way mill that combines the steps of forging and rolling. Blanks produced in this mill have uniformity and good grain flow. They are very strong; hence thinner sections can often be used. And their internal structure is so dependable that machining can be done with confidence. There is no hidden trouble lurking beneath the surface of the metal.

Bethlehem forged-and-rolled blanks are widely used in the making of gears, crane and industrial wheels, sheave wheels, flywheels, brake drums, turbine rotors, pipe flanges, and other circular products. They are available in a wide range of sections, and in sizes from 10 to 46 in. OD. Orders can be furnished heat-treated or untreated.

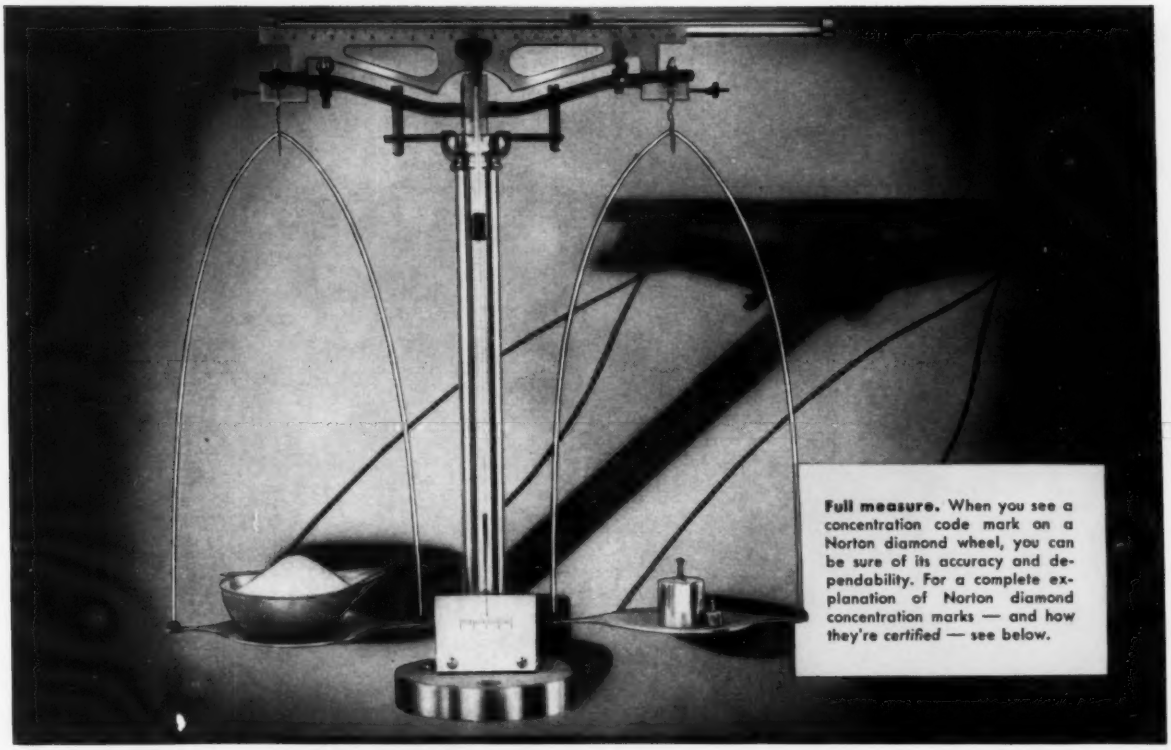
We suggest you get full details from the nearest Bethlehem office. Or write for a copy of Booklet 216, which contains many interesting facts and more than 80 photographs.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL



Full measure. When you see a concentration code mark on a Norton diamond wheel, you can be sure of its accuracy and dependability. For a complete explanation of Norton diamond concentration marks — and how they're certified — see below.

You get CERTIFIED DIAMOND CONCENTRATION with every Norton diamond wheel

Stamped on every Norton diamond wheel — or its container, in the case of various smaller wheels—you'll find a diamond concentration mark.

If the mark is 100, it means that each Norton 100 concentration diamond wheel contains an amount of diamond in carats calculated to a formula of 72 carats per cubic inch. Wheels of 75, 50 and 25 concentration of diamond contain 75%, 50% and 25% of this 100 concentration standard respectively.

The finished wheel contains the calculated number of carats of diamond except for the slight loss resulting from truing the diamond section to place the wheel in proper truth and condition for grinding.

Certified Accuracy

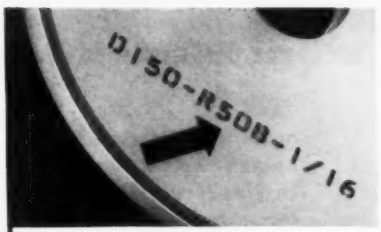
With each Norton diamond wheel you get a certificate of the accuracy of its diamond concentration, as marked. So, for your complete protection in diamond wheel buying, you can depend on this Norton marking to mean exactly what it says.

That's just one reason why it pays to buy Norton diamond wheels — made by the leader in diamond wheel development and manufacture. Norton was first to introduce all three types of diamond wheels — metal, resinoid and vitrified bonded . . . duplicates wheel specifications with constantly controlled accuracy . . . and does all its own sizing, grading and laboratory checking of diamond bort.

Your Norton Distributor

can give you prompt service on all types and sizes of diamond wheels. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

W-1837



The fourth and fifth numerals of this Norton diamond wheel concentration mark are 50, as shown here. Make this and all other certified concentration marks on Norton diamond wheels your buying guide to better grinding at lower cost.

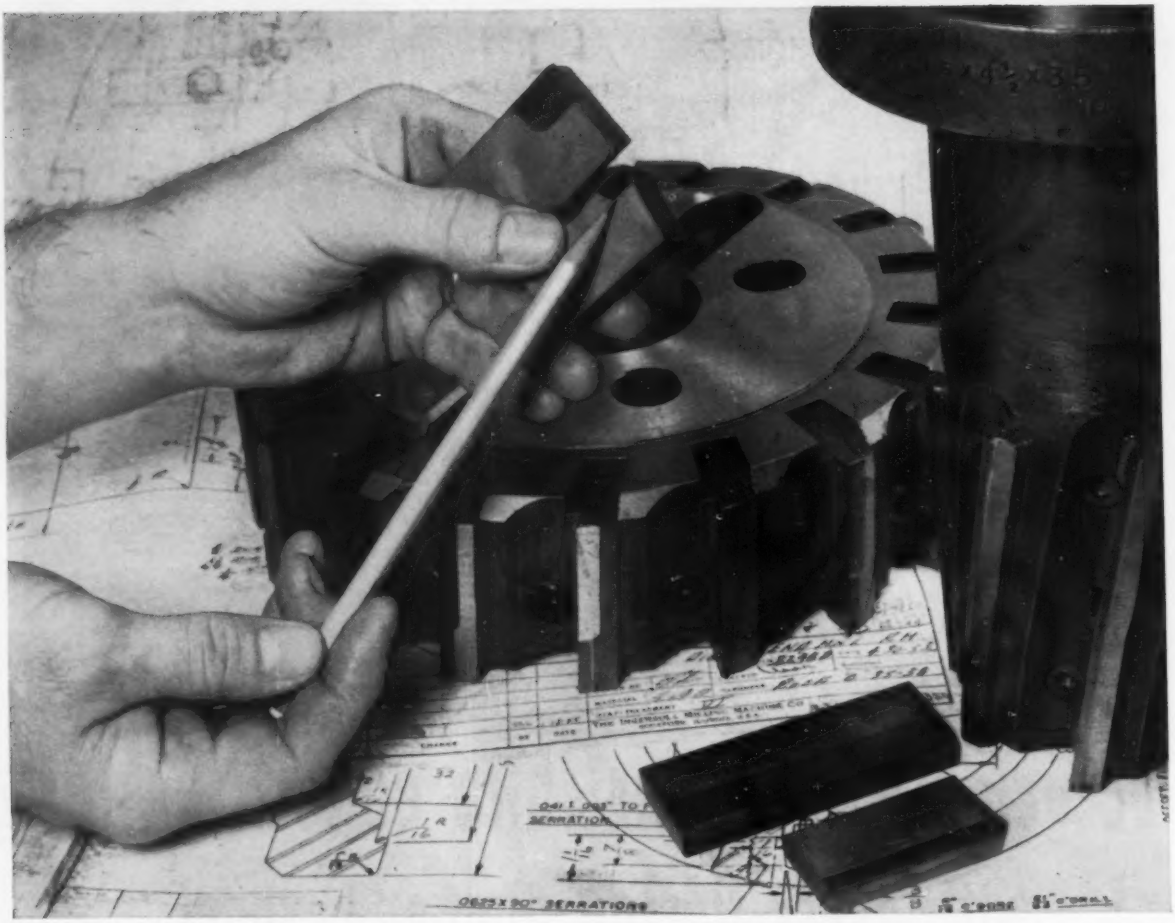
The complete line. Norton diamond wheels, the recognized "Crown Jewels" for value and performance, include sizes and types for every application, in every field — carbides, stone, glass, ceramics, electronics, etc.

NORTON ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



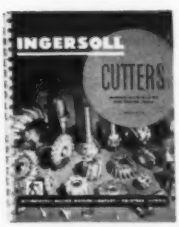
Ingersoll Type "NX" inserted blade Face Mills . . . for milling shoulders in steel or cast iron. Tips can be furnished any length to suit workpiece.

Worn Blades Are Only One Part Of Your Tool Costs

The initial price of the blades and the number of pieces produced between grinds, the design of the cutter and economical arrangement of the tip are all important considerations. Ingersoll's cutter service also includes a study of the machine, metal, speed, feed, rate of production and finish requirements. Only after considering all these can we recommend a cutter which will do your particular job best at the lowest cost.

We are used to working with these variables and offer you helpful counseling service as well as a proven line of cutters. Our job is to help you reduce your milling and boring costs, not just once but continuously.

We will welcome an opportunity to tell you more about this service. Write:



If you do not have a copy of this book, write us and we will send you one. It describes in detail the complete line of Ingersoll inserted blade milling and boring tools. Ask for Catalog #668

CUTTER DIVISION

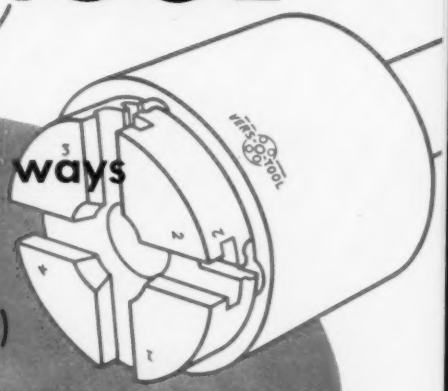
THE INGERSOLL MILLING MACHINE COMPANY

505 FULTON AVENUE ROCKFORD, ILLINOIS

Namco VERS-O-TOOL

lets you use the same head – two ways

- with chasers . . . (for threading)
- with cutters . . . (for hollow milling)



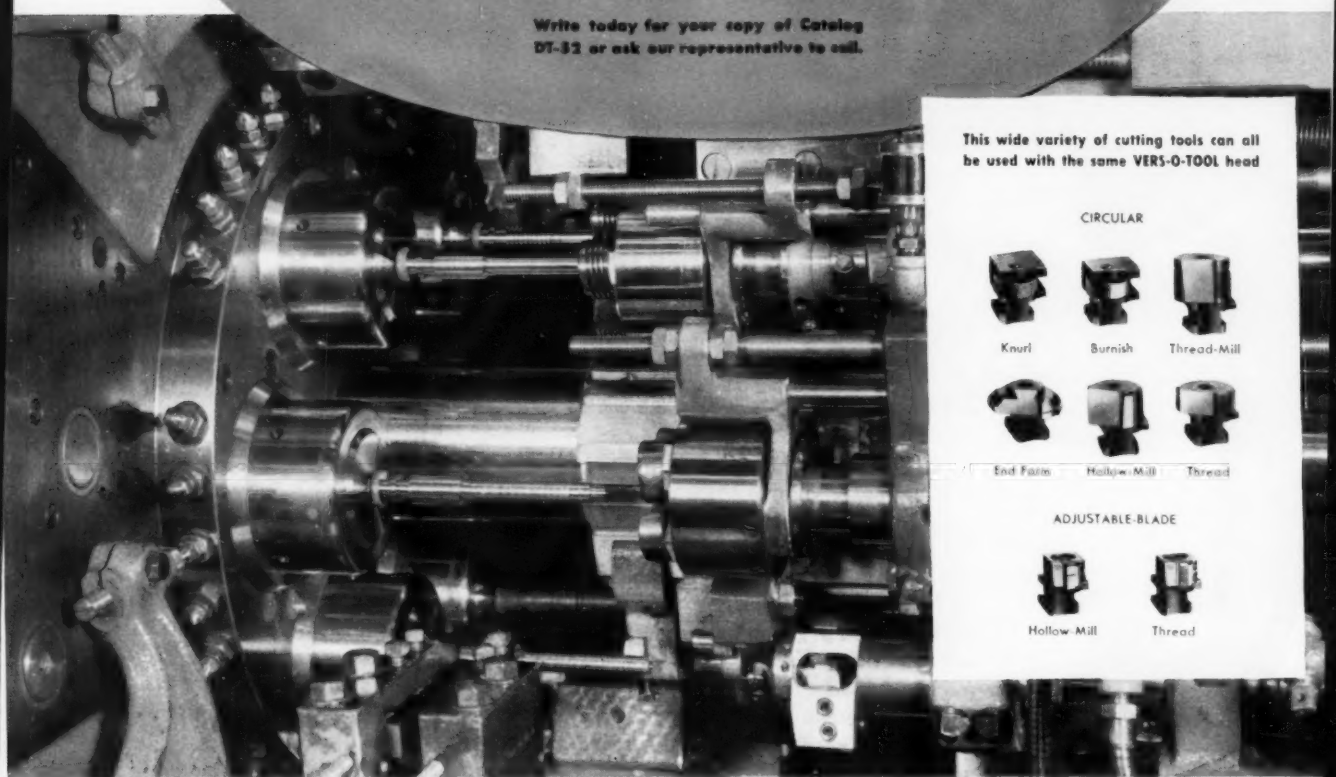
CIRCULAR CUTTING TOOLS reduce costs and speed production on threading jobs, end forming and turning.

GROUND THREAD CHASERS provide more threads per grind—and you can regrind to a full 270° of chaser circumference.

BASIC DESIGN SIMPLICITY—fewer moving parts—insures long, trouble-free performance.

NAMCO CHASER GRINDING SYSTEM permits cutter settings to be made in the toolroom without head adjustments—no need for trial error run after sharpening.

Write today for your copy of Catalog DT-52 or ask our representative to call.



This wide variety of cutting tools can all be used with the same VERS-O-TOOL head

CIRCULAR

ADJUSTABLE-BLADE

Three Namco VERS-O-TOOLS, on this 1¼" RA-6 Acme-Gridley Bar Automatic, hollow mill the stem and cut 2 thread diameters on cast bronze valve stem.

National Acme

THE NATIONAL ACME COMPANY, 179 E. 131ST ST., CLEVELAND 8, OHIO • Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 27, Mich.

Need Seamless Steel Tubing Immediately?

Get "out-of-stock" delivery Call your USS Shelby Seamless Distributor!

WHY WAIT FOR DELIVERY when you can get all the top-quality Seamless Steel Tubing you need from your close-at-hand USS Shelby Seamless distributor?

Phone him, write him, drop in and see him—and you'll get prompt, courteous and efficient service, the likes of which you've never seen before.

• The consistent high quality of USS Shelby Seamless Tubing, its dimensional accuracy and superior machining characteristics make it easy to fabricate. Use it and cut tool costs, reduce rejects, save both time and money, and turn out a finer product.

• Shelby Seamless is available in round, square, rectangular, and other special shapes in any commercial size—from ¼" OD to 10¾" OD and in wall thicknesses from .035" to 2.000" . . . in a wide range of steel grades and anneals.

— Contact your Shelby Seamless Distributor now! —

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS **SHELBY SEAMLESS MECHANICAL TUBING**

WALLS WITHOUT WELDS

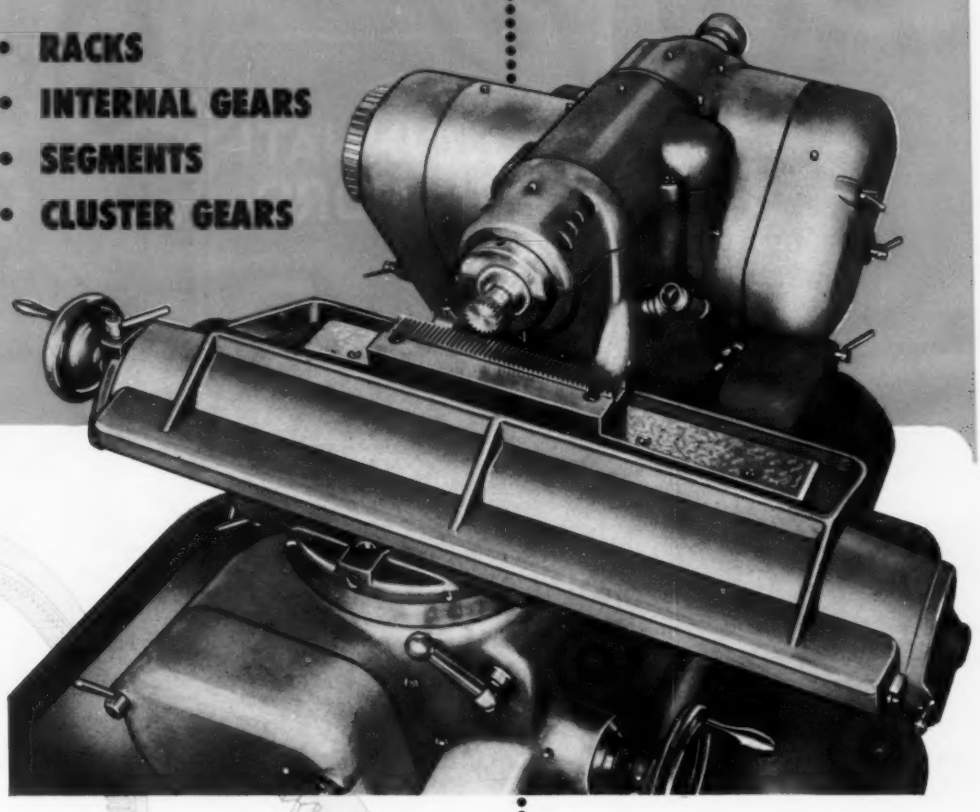
UNITED STATES STEEL

MIKRON

Fine Pitch

RACK & GEAR CUTTER
No. 134

...for
- **RACKS**
- **INTERNAL GEARS**
- **SEGMENTS**
- **CLUSTER GEARS**



ANOTHER machine in the MIKRON line— ***Controlled Accuracy, High Finish, Ease of Set-Up.*** **The precision cutter shapes as it generates tooth forms. The work meets your most exacting specifications and standards. Gear production requiring a shaping operation will be ideally performed with the MIKRON No. 134.**

WORK PIECE CAPACITY

RACKS
(Straight or Skew)
to 36" long x 1" wide.

SEGMENTS & CLUSTERS
to 3⅛" dia. x 1" wide.

INTERNAL GEARS
to 4" dia. x 1" wide.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

ALL NEW
CINCINNATI BICKFORD
Lever Shift
● Exclusive HERRINGBONE drive—the only radial built with this advanced feature.
● Pre-loaded, four-bearing spindle and chromium plated sleeve.
● Hydraulic arm and column clamping, special separate motors and complicated electrical controls are ELIMINATED!
● A positive lock-out of the power feed is available. When plunger is operated, it guards against accidental engagement of power feed during tapping or reaming.
● Head-moving handwheel is DE-CLUTCHED when head is traversed by power. Possible operator injury is completely eliminated.
● Two sealed-beam work lights, one on each side of spindle, never get hot . . . impervious to damage from chips and coolant.
● 36 speeds up to 2300 rpm, 18 feeds including 8 geared tap heads.

CINCINNATI BICKFORD

Super Service Radials

MODERN DESIGN and latest engineering developments built in the ALL-NEW Super Service Radial drilling machines give you *higher production . . . faster, safer operation . . . and greater machining accuracy*. Here are a few of the reasons why:

Exclusive de-clutchable HERRINGBONE DRIVING GEAR provides the necessary power to drive large diameter drills and heavy cutting tools for maximum penetration. When higher speeds are used, such as for small taps, the herringbone driving gear is de-clutched, eliminating excessive velocity.

Three head designs available—*lever shift control* of all 36 speeds and 18 power feeds; *complete hydraulic pre-selection* of speeds and feeds; *hydraulic pre-selection of speeds only*—manual control of power feeds.

A positive safety device is provided in the head traverse mechanism to guard against damage should the head strike the workpiece or other objects during traverse. This safety functions *at any point* of head travel on arm. Head-moving HANDWHEEL DOES NOT REVOLVE when head is being traversed by power.

A pre-loaded, four-bearing, chrome nickel spindle and chromium plated sleeve . . . supported in a *honed head bore* over 17″ long . . . assure maximum spindle rigidity, *regardless of position*.

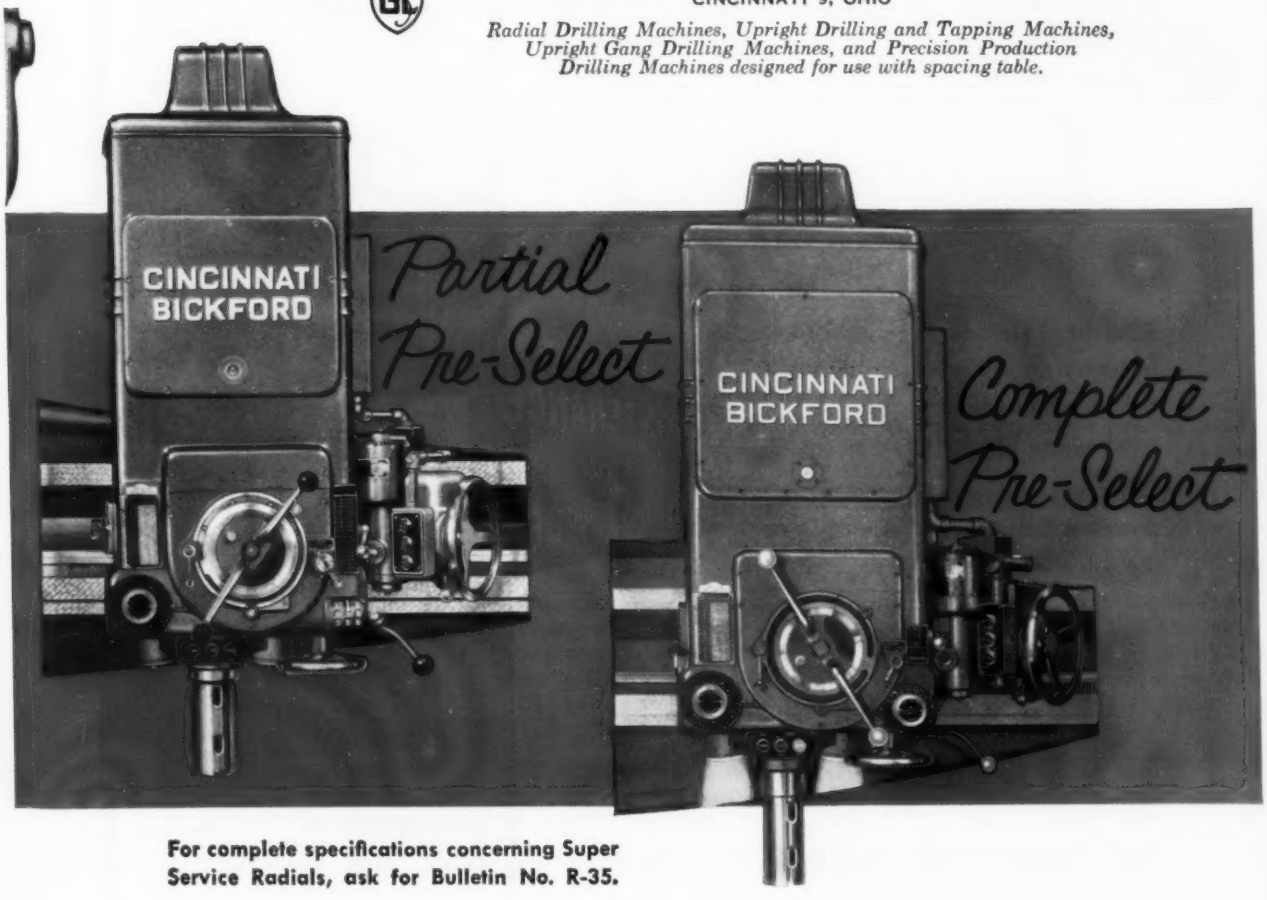
The ALL-NEW Super Service Radials are available with 13″, 15″, 17″ and 19″ dia. columns, and 4, 5, 6, 7 and 8-ft. arms. For complete specifications on these powerful radial drilling machines, see your nearest Cincinnati Bickford sales representative.

CINCINNATI BICKFORD DIVISION

GIDDINGS & LEWIS MACHINE TOOL CO.

CINCINNATI 9, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines, Upright Gang Drilling Machines, and Precision Production Drilling Machines designed for use with spacing table.

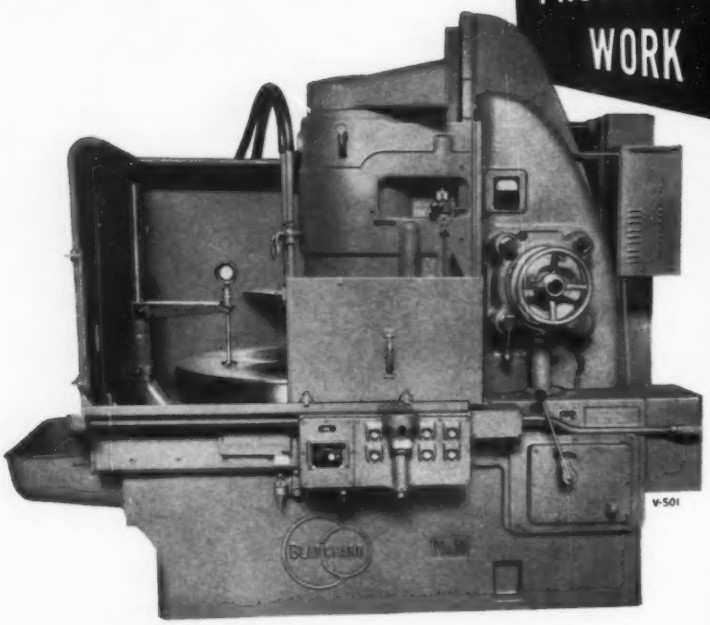


For complete specifications concerning Super Service Radials, ask for Bulletin No. R-35.

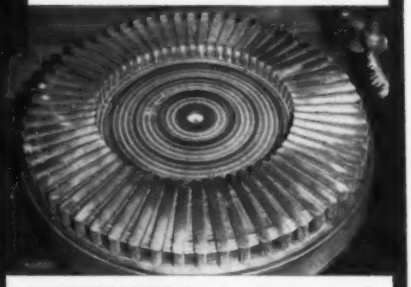
for BEST results in surface grinding...

PUT IT ON THE BLANCHARD

PRODUCTION WORK

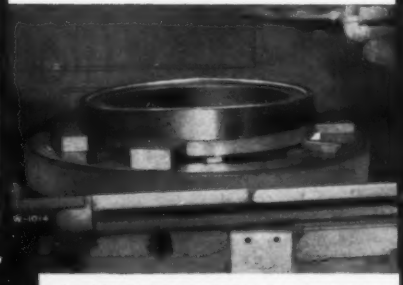


SIDE PLATES. 9" x 18" plates ground from rough on No. 18 Blanchard with 36" chuck. Stock removal 1/16" to 1/8" per side. Held flat within .003", parallel to .001", and to dimension tolerance of ± .001". Production: 30 surfaces per hour.



CONNECTING LEVERS. Cast iron levers ground in special magnetic fixture with pins located in "vee's". Stock removal per side is 1/32" to 1/16"; must be flat and at right angles to pins. No. 18 production: 180 pieces per hour, compared to 20 pieces per hour by former method used.

MAINTENANCE AND ODD LOT WORK



HARDENED STEEL PUNCHES. This 24-13/16" dia. punch, reground on a No. 18, is centered radially on 36" magnetic chuck. Duplicate circumferential and radial shear reliefs are generated with two setups.

GRANITE SURFACE PLATES. A No. 18 Blanchard reconditions this 18" x 34" granite surface plate by grinding it flat within .0002". 3/16" of stock is removed in 5 hours.

Blanchard Grinders are used throughout industry on surface grinding jobs that demand the utmost in production, finish and accuracy.

Whatever *you're* surface grinding, there's a Blanchard designed to do the job speedily and accurately.

PUT IT ON THE **BLANCHARD**

Send for free copies of "Work done on the Blanchard", fifth edition, and "The Art of Blanchard Surface Grinding".

THE BLANCHARD MACHINE COMPANY
64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

Use this easy-to-machine steel

TIMKEN® 52100 steel combines hardness, toughness and machinability that's ideal for making intricately shaped parts like slitter knives, aircraft torque wrenches, pump parts, bearing races, collets and machine tool parts.

The fully spheroidized structure of Timken 52100 steel makes machining easy—at no sacrifice in strength or hardenability. It's a high carbon chromium analysis of fine alloy steel with high fatigue and tensile strength, and good hardenability throughout its cross-section.

Timken 52100 steel withstands working pressures up to 200,000 p.s.i. It can be oil-quenched to a hardness of 65/66 Rockwell C. You can depend on uniform quality in every shipment, because we control quality through every production step—from furnace to final inspection.

The Timken Company is the only source of 52100 steel in all three finished forms—bars, tubing and wire. To meet your small run requirements and emergency needs, we stock tubing in 101 sizes—from 1″ to 10½″ O.D. We pioneered the production of 52100 tubing in America and we're the largest domestic producer. Write for a full list of sizes, grades and finishes available. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

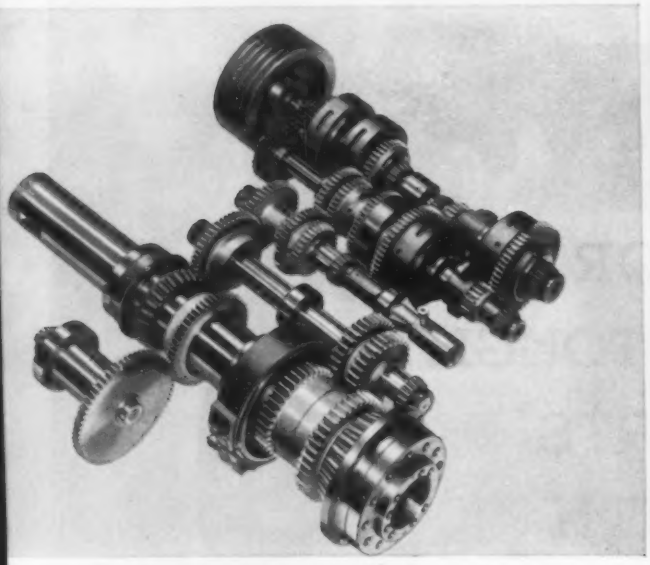
TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

For more information fill in page number on Inquiry Card, on page 227

WANT MORE POWER, MORE SPEEDS?

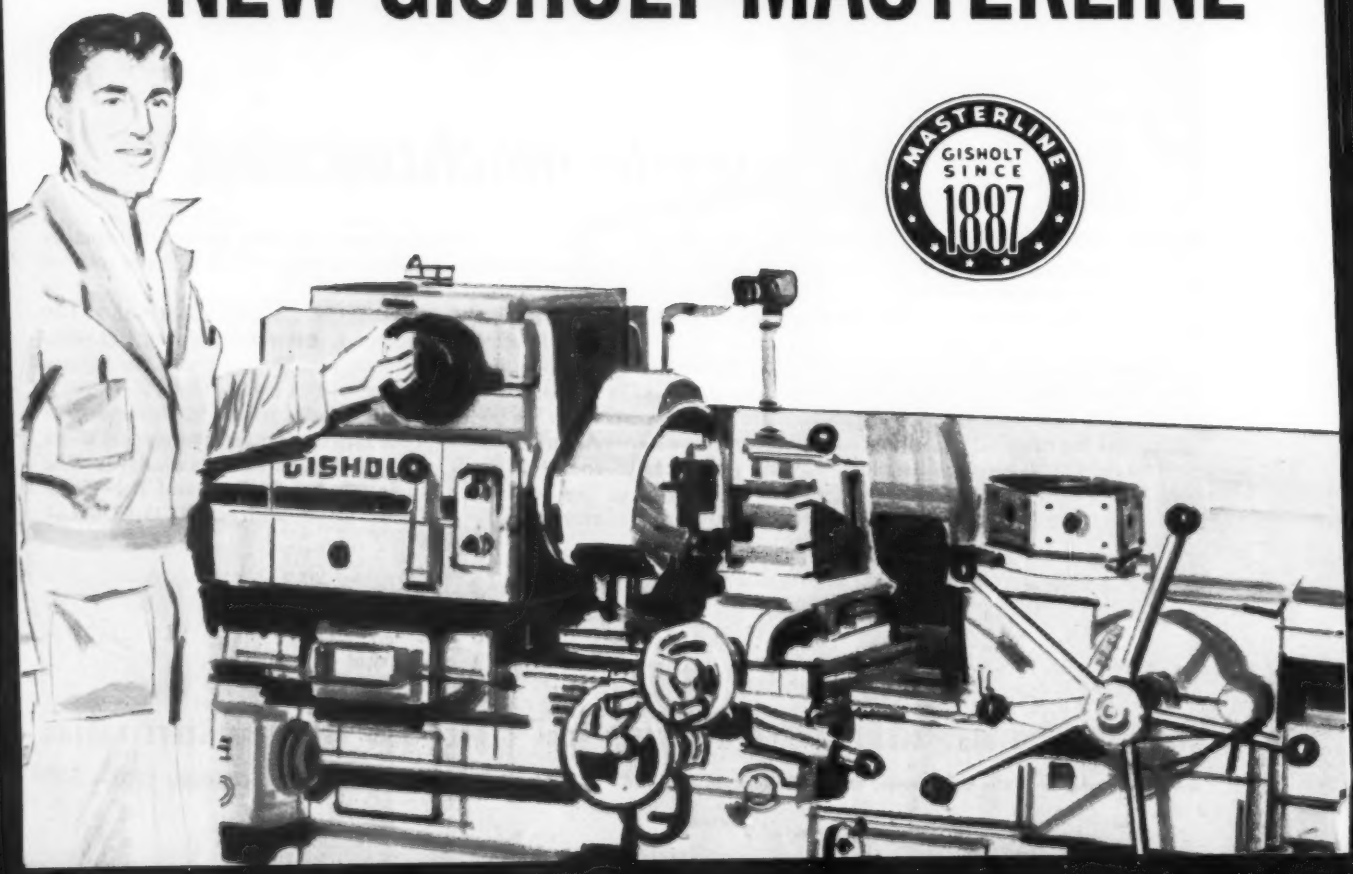


NEW HEADSTOCK GEAR TRAIN—sixteen different spindle speeds available, powered by up to 30 h.p. single-speed driving motor delivering full power at all speeds. Spindle is mounted on selected pre-loaded, precision-tapered roller bearings. Heavier, more rugged design provides smoother, quieter power.

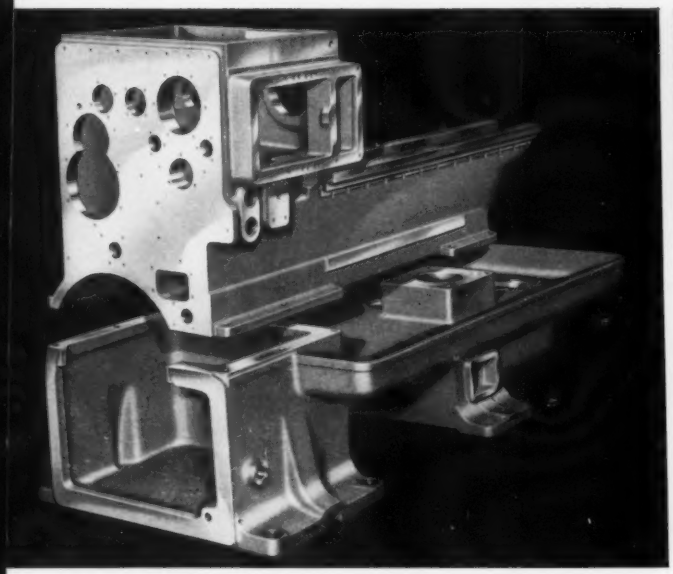
HYDRAULIC SPEED SELECTOR—smooth, effortless speed changes. No waiting, no computing, no stopping of spindle, no releasing of main drive clutch. Operates direct or pre-set. Hi-Lo Lever permits instantaneous speed changes in 8:1 ratio without moving Speed Selector handwheel. Multiple Disc Clutches have automatic take-up for wear.

YOU GET THEM ALL...PLUS

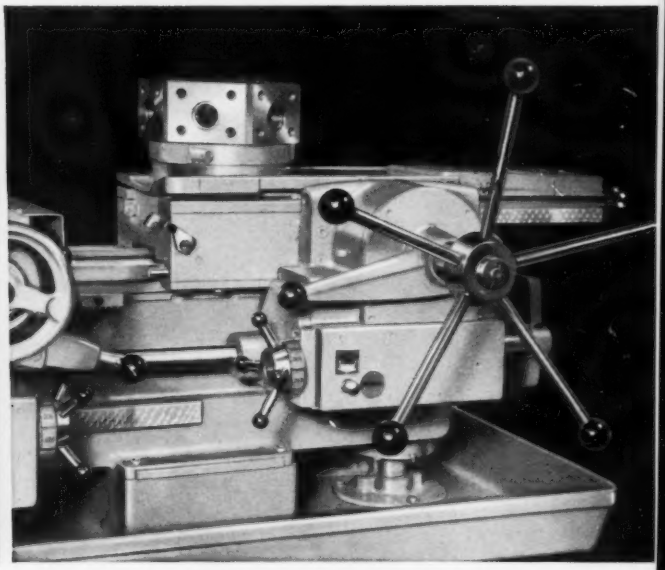
NEW GISHOLT MASTERLINE



WANT HEAVY CUTS WITHOUT VIBRATION?



NEW HEADSTOCK AND BED CASTING—scientific design dampens out vibrations, assures smooth operation and simplifies holding closer tolerances. Made from semi-steel, poured in Gisholt's own foundry. Greater swing over ways permits bigger chucks and broader range of workpiece sizes. Provides a solid foundation for all types of work.



NEW TURRET RAM AND SADDLE—designed wider, heavier, more rigid to handle increased capacity and higher speeds. Dial-type feed selector makes feed changes faster, easier. Turret ram rigidly supported on 64-66 Rockwell C alloy steel way strips. Power transmitted through serrated tooth clutches, with shear pin protection against overloading.

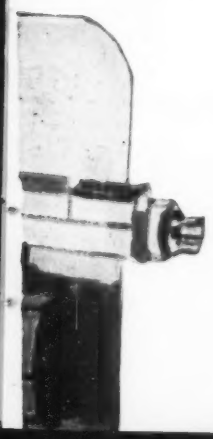
GREATER VERSATILITY...WITH THE

RAM TYPE TURRET LATHE

YOU'LL SPEED UP your production jobs—both large and small—with this more powerful, more versatile Gisholt MASTERLINE Ram Type Turret Lathe.

Here is a machine designed from end-to-end for easier setups, faster change-over and higher productive output than ever before. Check the advanced features illustrated above. Note the reserve power to handle your heaviest cuts—and to meet your tooling requirements of tomorrow. Note the extra spindle speeds—all at your operator's finger tips, without computing—for faster, better turning of any type material. And look over the new massive design, the over-all ruggedness that permits greater accuracy, closer tolerances, deeper cuts at punishing feeds without vibration.

Find out now how this powerful, flexible Gisholt MASTERLINE Ram Type Turret Lathe can reduce floor-to-floor time on your specific jobs. Call your Gisholt Representative today—let him show you how this advanced machine can fit most profitably into your production picture. Or write direct to Gisholt for the new literature described below.



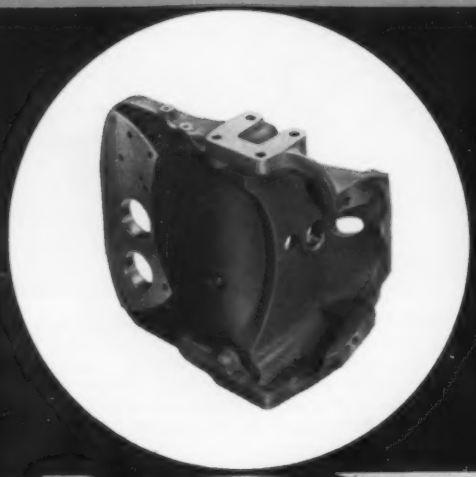
READY NOW—all-new, 18-page illustrated Bulletin No. 1174-B, covering features, accessories, tools and floor plans on new Gisholt MASTERLINE Ram Type Turret Lathes. Ask for it!

GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS



At Massey-Harris-Ferguson

Natcos Save 100 Parts...

Three multiple-spindle Natcos bore, drill, spotface and tap the front end support for a Massey-Harris-Ferguson tractor

NATCO

60 Man Hours Every

on Rugged Axle Support Castings

Massey-Harris-Ferguson checked it two ways. Nine general-purpose machines would do the job—or 3 Natcos. They chose the Natcos for these reasons:

- *Saving of $30,000 in machine cost*
- *Saving of 60 man hours every 100 parts*
- *Saving of 65% in floor space*

The Natcos handle all drilling, boring, spotfacing and tapping—a total of 67 operations on the 182-pound front axle casting. The casting is heavy, irregular—tough to fixture and clamp. The Natcos meet production requirement of 11 parts per hour.

Natco provided complete tooling which features automatic clamping, cycling and chip blow-out. All three machines are of unitized construction, giving Massey-Harris-Ferguson the flexibility to run different parts of redesigns of the same part.

Let Natco Field Engineers point out cost-saving and time-saving methods on your next drilling, boring, facing or tapping job. Natco offices are located in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland and Los Angeles; distributors in other cities.

National Automatic Tool Company, Inc.

Richmond, Indiana

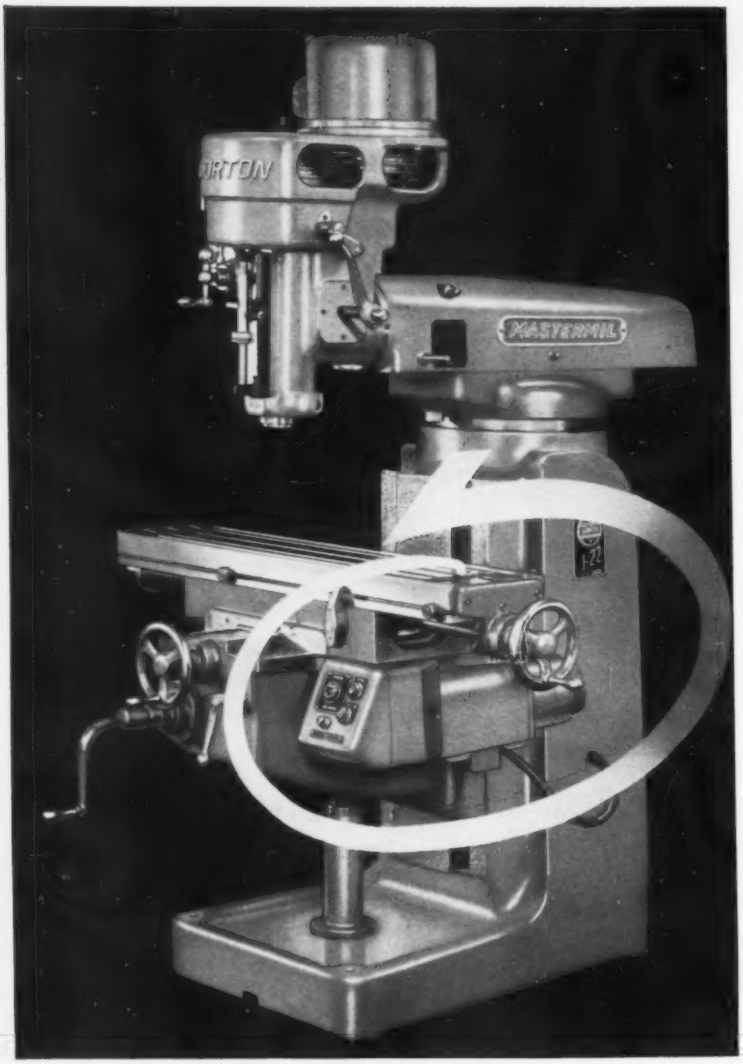
Multiple-spindle drilling, boring, facing and tapping machines. Special way-type, index and transfer machines.

For the first time — on any milling machine

ELECTRONIC DYNA-DRIVE

REGISTERED TRADE MARK

THE "TORQUE-THINKING" TABLE FEED



Yours
EXCLUSIVELY
with

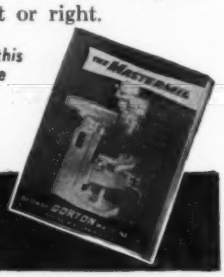
GORTON
MASTERMIL

It "feels"... as it feeds

• The exclusive Gorton Dyna-Drive® Table Feed unit "thinks while it works." It automatically adjusts to provide the exact amount of torque required. This electronic "brain" compensates during the cutting operation for small variation in density, hardness and molecular structure of the material being machined. Results are exceptionally fine finish and prolonged cutter life.

The Gorton Mastermil is precision-built throughout, simple, rugged with the finest milling head of any machine in its class. Ram adjusts in and out. Turret revolves and spindle swivels 90° left or right.

Learn more about this remarkable machine by writing for bulletin 2699-A—1301



GORTON

SINCE 1893

GEORGE GORTON MACHINE CO.

1301 Racine Street — Racine, Wisconsin — 56-1

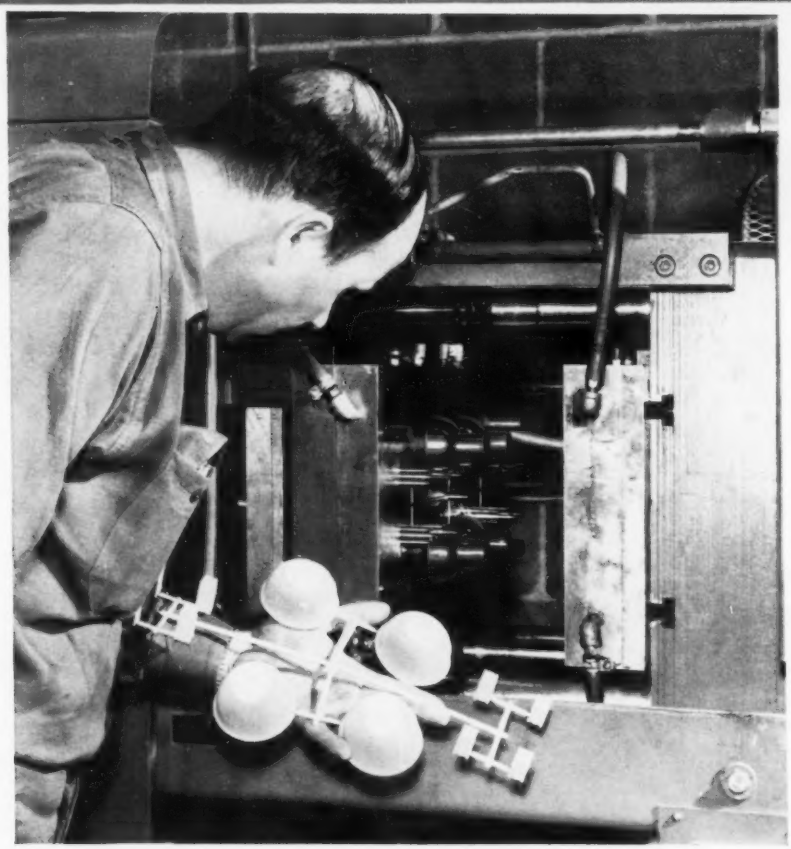
Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A7-1003-1P

For more information fill in page number on Inquiry Card, on page 227

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



For long runs and high polish they molded bowls with Lustre-Die

Our local tool steel distributor, Ford Steel Co., St. Louis, answered the question frankly. "If you're looking for high sheen on the finished product," they said, "and want a long-lasting die as well, we recommend Lustre-Die."

The die manufacturer, Lambert Engineering Co., St. Louis, put Lustre-Die to the test. They prepared the dies to produce plastic bowls used in a popular blender, for Chris Kaye Plastics Manufacturing Co., Madison, Ill. The result? Excellent die performance, and a fine looking product as well.

Lustre-Die is a really top-grade tool steel for making plastic parts because it has the properties which enable it to take an unbelievably bright polish. Lustre-Die not only has the proper basic analysis for working with plastics — we further improve it by alloy fortification, increasing its depth of hardenability and mechanical properties. It is heat-treated by oil-quenching and tempering, and is furnished ready for machining and polishing.

Lustre-Die is carefully made in the electric furnace. It undergoes close inspection to insure cleanliness. Moreover, it is free from injurious porosity or surface pitting.

Any way you look at it, Lustre-Die is fine tool steel, and a good performer. If you would like full information, check with your Bethlehem tool steel distributor.

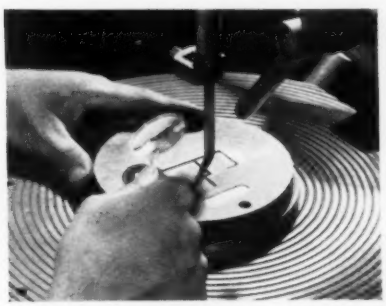
BETHLEHEM TOOL STEEL ENGINEER SAYS:

There's No Scorch With Proper Grinding

The redressing of worn tools by grinding is often done improperly. This causes a lower service life after regrinding than on the original grind.

The most common error in regrinding tools is the removal of metal so rapidly that the heat generated causes a "tempering back," or softening of the steel in areas which have been ground. Thus, the reground tool is softer in the working areas than it was originally, and therefore wears more rapidly. Abusive grinding is almost always accompanied by scorching, which produces purple, blue and yellow temper colors where the grinding has been done.

Many operators realize that the appearance of scorching is an indication of improper grinding, and they therefore make it a point to remove the scorched areas with a final, light grinding pass. This removes the visible evidence of scorch but does not remove the harmful effects. Tools which are being properly ground do not develop scorch in grinding.



USE CROMO-WV DISCS TO EXTRUDE ALUMINUM

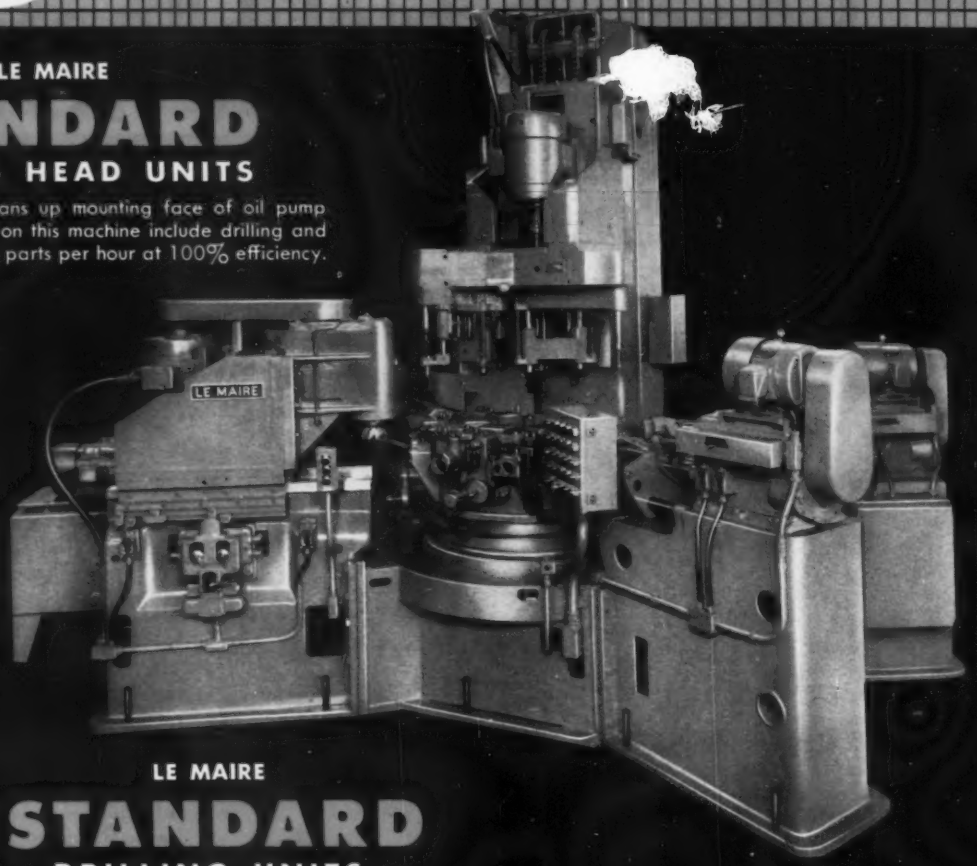
This Bethlehem upset-forged disc, to be used in extruding aluminum, is made of Cromo-WV Hot-Work tool steel. Cromo-WV makes possible increased production of aluminum extrusions because it is resistant to heat-checking, and has adequate wear-resistance and toughness. Cromo-WV also responds accurately to heat-treatment. It's good tool steel — worth ordering for your next extrusion job.

PRODUCING

LE MAIRE

STANDARD
MILLING HEAD UNITS

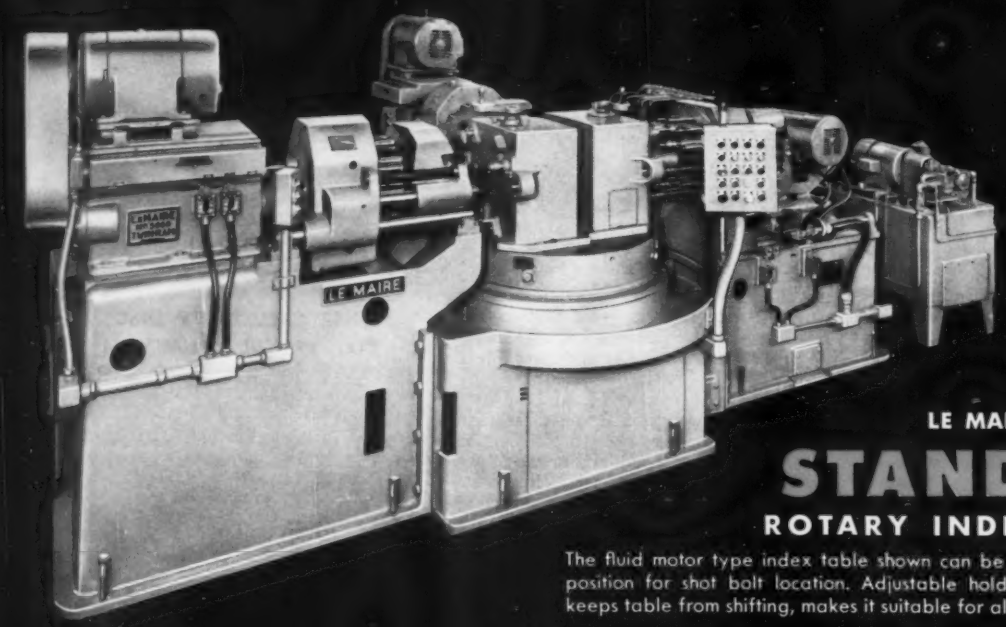
Vertical milling head cleans up mounting face of oil pump covers. Other operations on this machine include drilling and reaming. Production is 90 parts per hour at 100% efficiency.



LE MAIRE

STANDARD
DRILLING UNITS

Multiple tooling on standard units performs drilling, reaming, counterboring and tapping of 75 flywheels hourly. While units shown are quill type, LeMaire also manufactures standard way type units.



LE MAIRE

STANDARD
ROTARY INDEX TABLES

The fluid motor type index table shown can be set to stop in exact position for shot bolt location. Adjustable hold-down arrangement keeps table from shifting, makes it suitable for all types of machining.

with LE MAIRE

STANDARD BUILDING BLOCKS

Give You Economy . . . Flexibility . . . Simplicity

Before you automate . . . *investigate* the complete LeMaire line of standard hydraulic power units. Each is practical, efficient, economical . . . and nearly as flexible in application as a standard electric motor!

These LeMaire "building blocks" are designed for interchangeable installation on a wide variety of standard bases. This allows low-cost unitized construction, in minimum lead time, of a "special" which solves *today's* production machining problem . . . and which can be economically converted or modified to meet *future* needs.

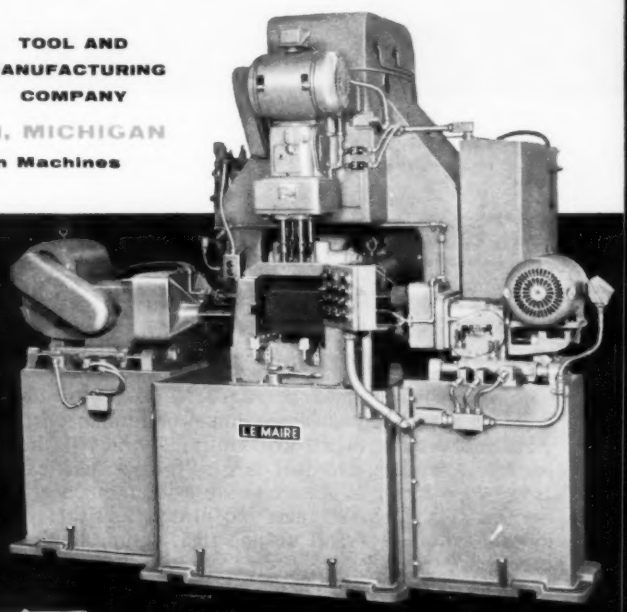
LeMaire standard units are suitable for drilling, boring, counterboring, reaming, spot-facing, tapping and milling. They operate in horizontal, vertical or angular positions. Infinite control of feeds is provided, along with construction which assures twist-free, straight line, uniform operation under all production conditions. All units are built to J.I.C. standards.

For practical, economical, flexible automation, check the possibility of using LeMaire "do-it-yourself" building blocks . . . or ask LeMaire engineers to recommend the right combination for your specific production machining problem. Send parts or prints for prompt recommendations.

LE MAIRE TOOL AND MANUFACTURING COMPANY

2657 S. TELEGRAPH ROAD • DEARBORN, MICHIGAN

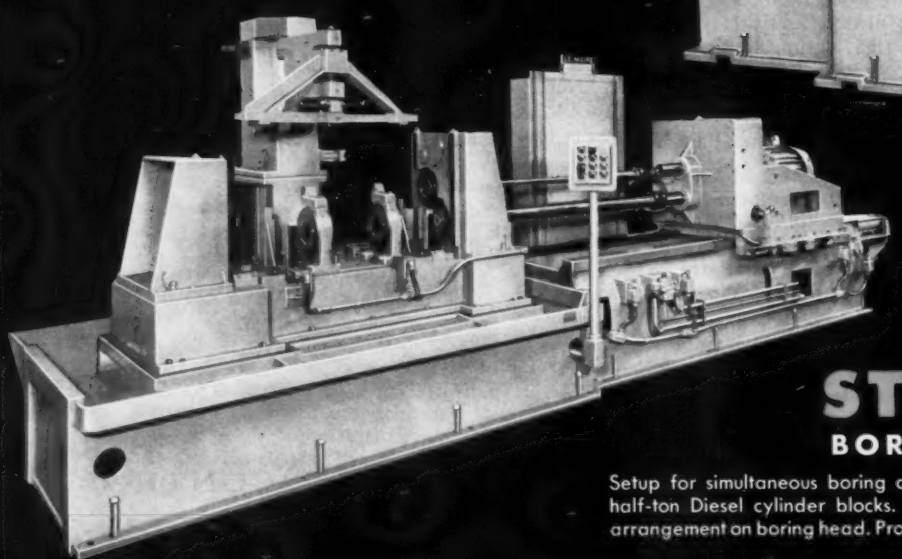
Designers and Builders of Special High-Production Machines



LE MAIRE

STANDARD
LEAD SCREW TAPPING UNITS

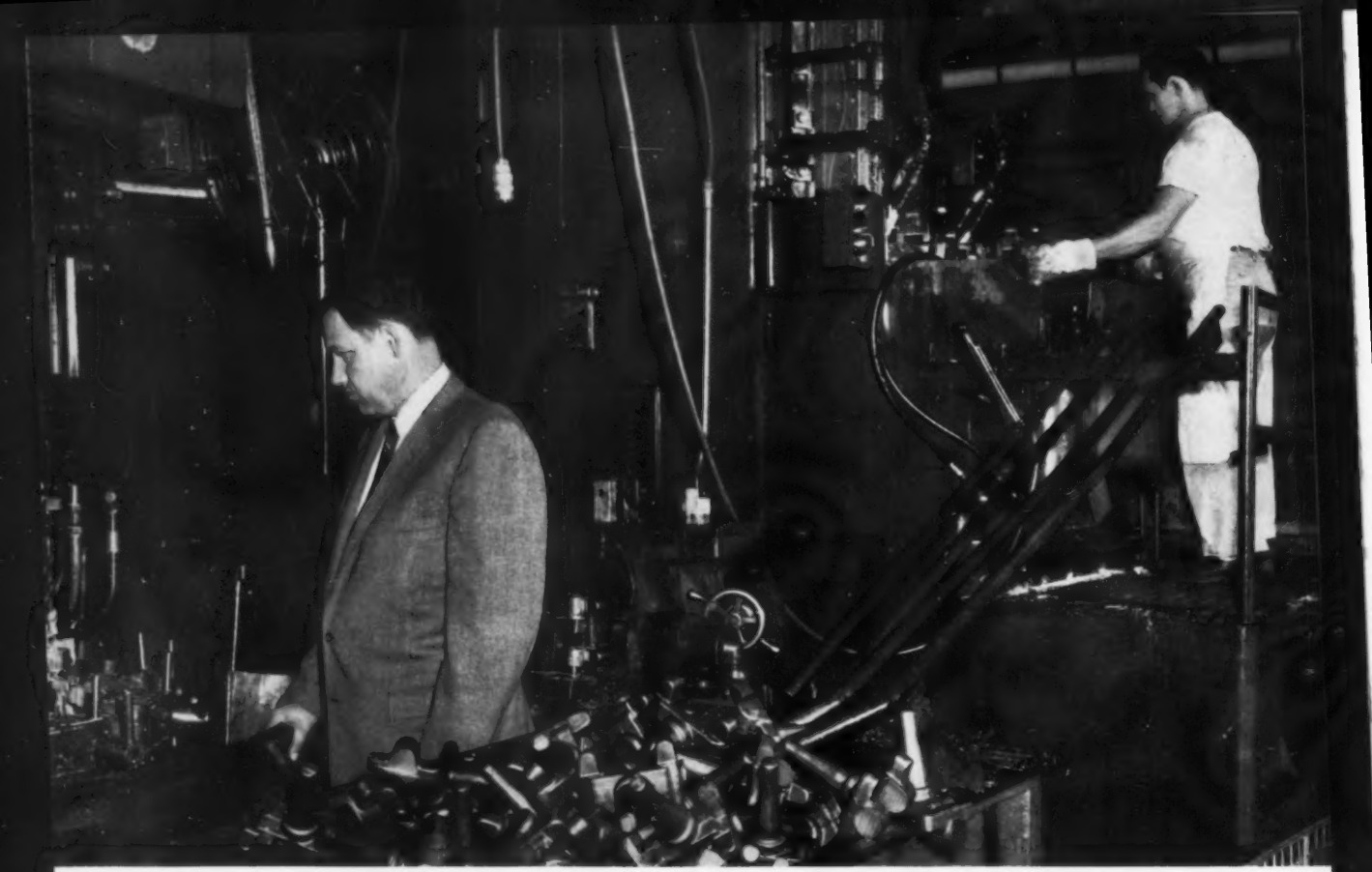
Four sides of farm tractor hydraulic reservoir are tapped at once by this machine, arranged with various size master lead screw tapping units. Production is 56 parts per hour at 100% efficiency.



LE MAIRE

STANDARD
BORING HEAD UNITS

Setup for simultaneous boring of camshaft and crankshaft bores in half-ton Diesel cylinder blocks. Way type unit has tool positioning arrangement on boring head. Production is 9.4 cylinder blocks per hour.



Arthur Grayson, Jr., Purchasing Agent of LeRoy Machine Company, LeRoy, N. Y., inspects equipment used in making automobile spindles and other auto parts. Machining efficiency is maintained through the use of Texaco Cleartex Oil, Sultex Oil, and Texaco Soluble Oil emulsion. Texaco Regal Oil R&O is used to keep hydraulic equipment free from rust, sludge and foam.

"Texaco helps keep operating costs down on more than 300 different machines"

— *reports Arthur Grayson, Jr., of LeRoy Machine Co.*

"Texaco has helped us get maximum performance from our heavy-duty metal working machines—lathes, broaches, grinders, and drill presses—for over ten years. How? One factor is Texaco's Lubrication Engineering Service. Texaco makes sure we always lubricate our machines properly—and use the right cutting fluid for each job."

Texaco service can save money and improve machine performance for you, too. The Texaco Lubrication Engineer begins with a complete plant analysis, and then adapts the following four-point program to your specific plant conditions:

- **He shows you how to cut inventory, through the use of selected multi-purpose cutting oils and lubricants.**
- **He shows you how to use these products for dependable operation, maximum production, and lower maintenance costs.**
- **He anticipates your needs by regular surveys and practical follow-up suggestions.**
- **He keeps on offering the most up-to-date products and information on how to use them.**

A Texaco Lubrication Engineer is ready and willing to offer complete information on Texaco products and service. Call the Texaco Distributing Plant nearest you—there are more than 2,000 in the 48 states—or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, New York.

TUNE IN... Metropolitan Opera Radio Broadcasts Every Saturday Afternoon

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

- Sputniks Decoded?
- Emergency Washington
- Project Research Blasts Off
- Rear Guard Tax Action

Keeping up with Washington

LORING F. OVERMAN

THERE'S a growing suspicion in Washington that "Open Sesame" was the radioed message of the sputniks. At every mention of the satellites, doors to the Treasury open a bit wider as defense planners sense the need or the opportunity to win budget increases.

First reports that the $38,000,000,000 defense budget ceiling would remain intact for fiscal 1959 have already been pierced. Instead, according to Defense Secretary Neil McElroy, defense expenditures for the year could reach $40,000,000,000. The total would include some $2,500,000,000 in 1959 for the missiles system program. It has been indicated that missiles system expenditures by 1960 would equal those allotted to aircraft programs. These estimates will be of interest to those who provide the machines which fashion both systems of armament.

Initial forecasts were that the missiles program could be financed largely by curtailing other military activities. Current view is that the American taxpayer will accept increased levies in exchange for the assurance that the Nation is again up front.

Emergency Washington

Washington is becoming disturbingly concerned over what to do if attacked. Prior to the sputniks, the subject received rather casual consideration. Not now. "Fifteen minutes from zero" is the way some observers view things. Our radar network could give us a two-hour warning against enemy jet bombers. With intercontinental ballistic missiles, the warning could be 15 minutes or less.

Instant reaction, defense-wise and otherwise, is now the goal of the planners. "We need great advances in weapon systems to assure instantaneous reaction," said Air Force Chief of Staff General Thomas D. White.

Continuing liaison between industry and government is provided for in the recent appointment of twelve career employes as directors of divisions in the Business and Defense Services Administration. Many replace WOC officials loaned by private industry for six-month duty tours without government compensation. The replacements implement a policy change agreed upon as a result of congressional criticism.

New directors of divisions with which machinery manufacturers are primarily concerned are the following:

Metalworking Equipment Division—Niels A. Olsen, deputy director of the division since 1954 and military liaison officer with the War Production Board during World War II. He also served with the Logistics Division, War Department General Staff.

General Industrial Equipment and Components Division—Charles F. Hughitt, former acting director, Consumer Durable Goods Division.

Miscellaneous Metals and Minerals Division—Harry B. Sharpe, deputy director of the division since 1953. He also served with the War Production Board and NPA.

WOC directors still serving five BDSA divisions in late November are to be replaced with career employes when their on-loan terms terminate. Of interest to machinery people are three of these divisions—Iron and Steel, Power Equipment, and Electrical Equipment. WOC's will continue to serve as assistant directors.

Pertinent, although not new, is the information in a just-published report of a conference of industry and BDSA officials held last February. This 36-page report is entitled "Industry Planning for the Continuity of Production in the Event of Enemy Attack." The publication (PB 131000) is available at 50 cents per copy from the Office of Technical Services, Department of Commerce, Washington 25, D. C.

Project Research Blasts Off

Government encouragement for basic research, through tax incentives to business and financial inducements to students, is under consideration. Such actions were recomended by the Economic Stabilization Sub-Committee of the Congressional Joint Economic Committee. Need for basic research is seen in an Air Force official statement which observes: ". . . missiles and rockets are but interim measures between manned high-speed air-breathing vehicles and manned space flight. Whereas there are now those who have the capability to control the land and sea beneath, so in the future it is likely that those who have the capability to control space, will likewise control the earth's surface."

The White House staff now boasts a Missiles Coordinator; the Defense Department, a Guided Missile Director. At the White House is James R. Killian, president, Massachusetts Institute of Technology. Serving with the Department of Defense is William M. Holaday, who is to "direct all activities in the DOD relating to research, development, engineering, production, and procurement of guided missiles."

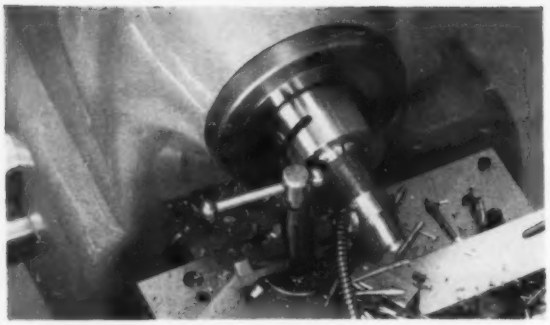
Rear Guard Tax Action

Despite evidence that sputniks have pried open doors to the Treasury, some citizens' groups still press for government economy and tax reduction. "Finance increased defense spending by curtailing unnecessary government services in civilian fields," some suggest.

Legislation to overhaul present tax procedures will be urged in testimony before House Ways and Means Committee hearings starting January 7.

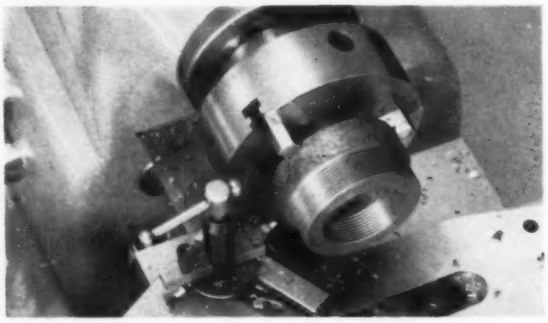
HARDINGE
ELMIRA, N.Y.

"The Outstanding Tool Room Lathe"



Precision Collet work for all sizes to 1 – 1/16" Collet seats *directly* in spindle.

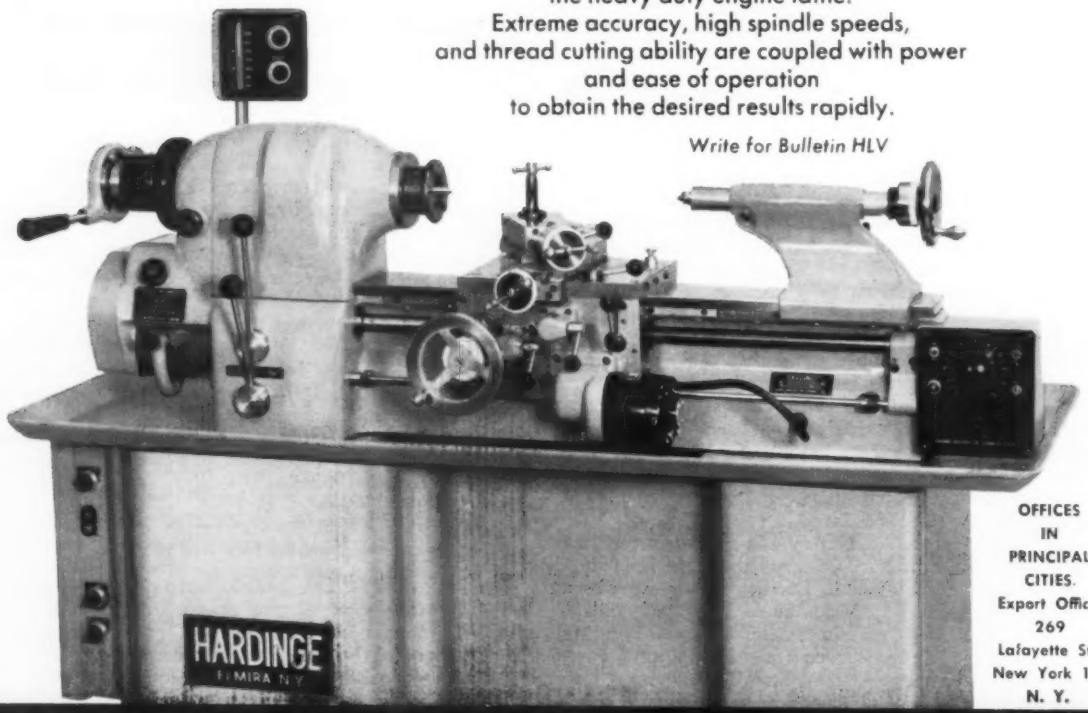
Precision Step Chucks for diameters up to 6". Provides Collet-like accuracy.



Integral Mount Jaw Chucks for precision holding of regular or irregular shapes up to 5".

Hardinge Model HLV 10" Lathe was primarily designed to fill a very old existent gap between the plain precision bench lathe and the heavy duty engine lathe.
Extreme accuracy, high spindle speeds, and thread cutting ability are coupled with power and ease of operation to obtain the desired results rapidly.

Write for Bulletin HLV



OFFICES IN PRINCIPAL CITIES.
Export Office: 269 Lafayette St., New York 12, N. Y.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

For more information fill in page number on Inquiry Card, on page 227

Machinery
JANUARY 1958

The Vitality of Industry

ONE OF THE PHENOMENA of our age is the genesis of big manufacturing plants for turning out products that were unknown to even our immediate ancestors. Television, for example, has resulted in the establishment of factories employing thousands of persons for making broadcasting equipment and reception sets. Jet planes and air missiles are additional examples of recent developments that have expanded the number of manufacturing plants. Electronics is another branch of modern science that is providing the foundation for a variety of products that must be factory-made.

Important business often results from the manufacture of small items that the general public knows little about. Of recent origin are the semiconductors used in components of electronic circuitry, such as diodes, rectifiers, and transistors.

These semiconductors utilize tiny pieces of germanium or silicon that permit electric current to pass through the device in one direction only. Because of this characteristic, semiconductors are capable of converting alternating current into direct current without the necessity of employing the larger and more costly components heretofore required for the same purpose. They also provide a higher degree of reliability and miniaturization than is possible with the vacuum tube.

The manufacture of semiconductors is already a booming industry, which did about a $125,000,000 business in 1957. Informed persons predict that the business will expand to a volume of $450,000,000 by 1961 because of continuing discoveries of new uses for semiconductors.

Consistent with the progressiveness of industry, greater volume of production in this field has led to lower manufacturing costs. And so, a germanium diode used in great volume for computers, which sold for $5 only four years ago, is now available in quantity for 70 cents apiece. A silicon power rectifier, which cost $7 only one and one-half years ago, was recently reduced to $3.

There is a certain romance about any new industry and especially so when the manufacturing processes are out of the ordinary. It is for this reason that the leading editorial article in this issue of MACHINERY, which describes operations in the semiconductor plant of one of the most important companies in the field, is presented in somewhat dramatic fashion by the use of four-color illustrations.

The vitality of American industry, which this article emphasizes, should be dramatized! It is the hope of our people as the nation grows to the high level of population predicted for the years to come. New inventions and manufacturing plants for their production will be needed to sustain the expanded population economically. Science and industry will surely meet that need.

Charles O. Herb

EDITOR

New facts on inventory costs revealed by IRON AGE survey

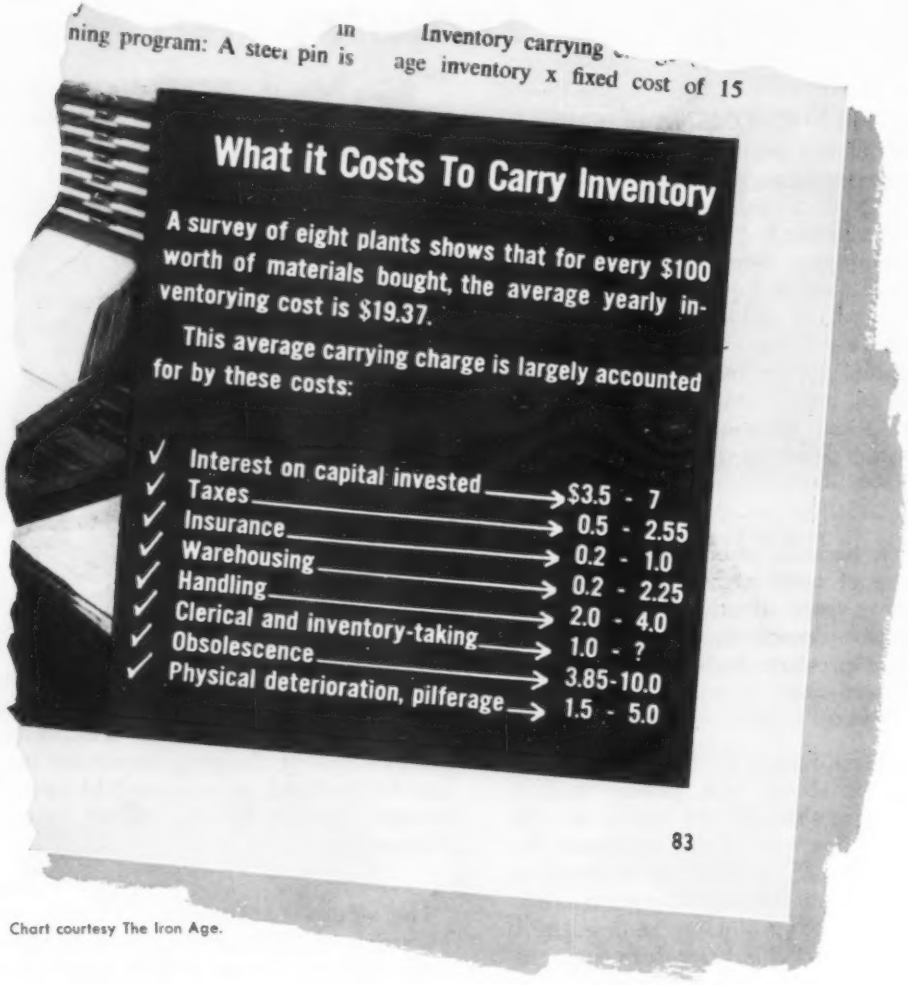

ning program: A steel pin is
Inventory carrying
age inventory x fixed cost of 15
What it Costs To Carry Inventory
A survey of eight plants shows that for every $100 worth of materials bought, the average yearly inventorying cost is $19.37.
This average carrying charge is largely accounted for by these costs:
Interest on capital invested $3.5 - 7
Taxes 0.5 - 2.55
Insurance 0.2 - 1.0
Warehousing 0.2 - 2.25
Handling 2.0 - 4.0
Clerical and inventory-taking 1.0 - ?
Obsolescence 3.85-10.0
Physical deterioration, pilferage 1.5 - 5.0
83

Chart courtesy The Iron Age.

Here's help on steel inventory costs . . . In these days when working capital is tight and interest rates are high, it's especially important not to let inventory take dollars you can use elsewhere. You can save money on steel inventory costs by letting Ryerson carry the inventory for you. It's already here, at Ryerson—in the nation's largest stocks of steel. And Ryerson has the organization to deliver what you want when you want it. For immediate steel service, call the Ryerson plant near you.

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A tiny work horse no bigger than the head of a match will be bringing about big changes throughout industry during the next few years

AUTOMATION'S "LITTLE GIANT"

JOSEPH S. O'FLAHERTY, Manager, Semiconductor Division
Hughes Aircraft Co., Los Angeles, Calif.

SEMICONDUCTORS are rapidly replacing vacuum tubes in all types of electronic circuitry. Essentially, semiconductors are diodes, rectifiers, and transistors with sliced, diced, plated, and refined pieces of germanium or silicon as their hearts.

In automated equipment, the semiconductor is the key part of the electronic "brain" which takes orders from human masters and translates them into a language machines can understand and obey. In this respect, it is similar to the ordinary vacuum tube that has been in existence since the early days of radio. But the semiconductor also has a number of features all its own that are making possible the rapid automation of complex manufacturing processes.

A semiconductor takes one-tenth the space of a vacuum tube. It requires only minute amounts of power. (Those used in hearing aids run for months on a battery the size of a thumbnail.) Of extreme importance to automation, where failure of one circuit can tie up an entire production line, is the greater reliability of the semiconductor over the vacuum tube.

Generating only insignificant amounts of waste heat, semiconductors eliminate the need for cooling devices where used in large numbers. At the same time, they function perfectly in environments of extreme temperature or vibration that would make vacuum tubes fail within minutes. And as a kind of electronic bonus, a semiconductor not only does the vacuum tube's job, but also can be trained to sense minute temperature changes and to distinguish between light and darkness.

These characteristics make practical the compact computers being built today that were impossible to make

Fig. 1. Technician watches crucible of molten silicon in drawing operations. Standards require as little as one part of impurity to one billion parts of silicon in the drawn crystals.

to bulky alternating-current–direct-current converters. Then too, should he air-condition the plant, he gains another benefit. The air-conditioners he installs can be smaller, because they won't have to siphon the waste heat from hundreds of glowing vacuum tubes.

Last year America's booming semiconductor industry, consisting of some forty companies, did a $125,000,000 business. Continuing discoveries of new uses for semiconductors have led at least one authority to forecast a $450,000,000 volume by 1961. At the same time, constantly improving technology in producing semiconductors is bringing price reductions each year. For example, a germanium diode, used in great volume in computers, which sold for $5 four years ago, now sells in quantity for 70 cents; and a silicon power rectifier, which sold for $7 only a year and a half ago, already has been reduced to $3.

Hughes Aircraft is today considered a leading factor in the industry. Sales of this company's Semiconductor Division are expected to exceed $35,000,000 in 1958.

ten years ago. Such computers and related equipment, physically small, yet rugged enough to operate well under adverse factory conditions, will be doing the "thinking" for automated processes.

An example of what semiconductors can mean to automation: A metalworking manufacturer decides to set up a plant to perform a machining sequence on a highly automated basis. Using equipment designed with semiconductors rather than vacuum tubes, he can reduce the floor space required for cabinets and control consoles more than 90 per cent; and he can reduce the power requirements of the controls more than 50 per cent. Because semiconductors normally last ten times as long as vacuum tubes, he can cut maintenance costs of the control equipment as much as 90 per cent. And since semiconductors are so much more reliable, he minimizes the chances of line shutdown due to control failure.

In addition, thanks to a new semiconductor rectifying device, he avails himself of the efficiency and versatility of direct-current-powered machinery, without resorting

Fig. 2. Coils passing along the tube melt the germanium, causing impurities to concentrate. In the process, a large crystal grows from each seed placed in the boats.

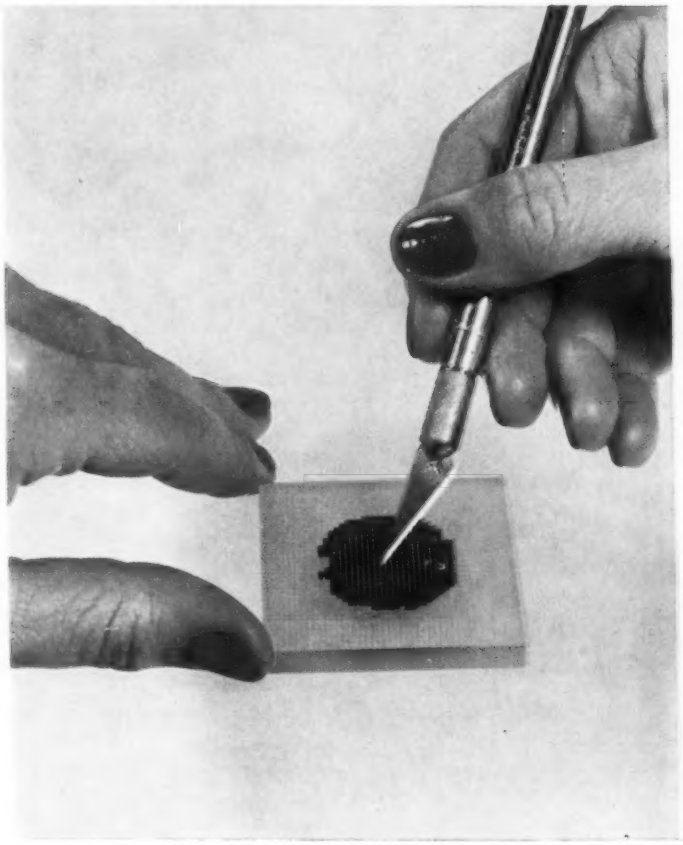
Fig. 3. Strands of pure gold are wound around a heating element. Later, the crystals are plated with the gold when the strands are evaporated in a high-vacuum chamber.

Highlights of semiconductor-making techniques at the Hughes plant appear in the accompanying illustrations.

The initial stage of manufacture of a silicon semiconductor, shown in Fig. 1, consists of vertically drawing a silicon crystal from an induction-heated electric furnace. Molten silicon is contained in a quartz crucible within the induction coil. To draw a perfect crystal, the technician lowers a small rotating seed of the crystal into the molten mass, then slowly withdraws the seed as the silicon solidifies around it into a relatively large cylindrical crystal. The process assures a necessary extremely high degree of crystal purity.

A continuing source of seeds is obtained by selecting the finest available in a current crop with which to grow the next crop. Those selected first undergo exhaustive X-ray and other analyses.

For germanium semiconductors, crystals are obtained by processing the material in quartz boats within a long tube, Fig. 2. Resistance-heated coils move down inclined planes beneath the tube, their rate controlled by a lead-screw driven by a gear-motor. In passing along the tube, each coil melts the germanium in the immediate area. Impurities tend to concentrate in one end of the boat. As with the silicon, a large crystal grows from a seed. The melting operation is carried out in an inert-gas atmosphere.



After the silicon and germanium crystals cool, they are sliced into thin wafers, then plated with gold to assure perfect electrical contact in final assembly. Preparatory to the plating, strands of pure gold wire are wound onto a tungsten helical heating element, as in Fig. 3. When the element is then put in a chamber, the gold is evaporated by high vacuum and deposited on the wafers.

Next, the wafers are mounted on a firm base and sawed into hundreds of tiny dice, each of which ultimately becomes the heart of a semiconductor. In Fig. 4, the technician inspects the dice, removing those not square with a knife. The perfect dice are separated from the base in an acid bath.

Meanwhile, in another area in the plant, lead wires are etched to remove rust and other impurities; and "cat whiskers" are

Fig. 4. Between 400 and 500 dice are obtained from each wafer. Technician lifts imperfect dice off the base with a knife. Each die becomes the crystal heart of a semiconductor.

Fig. 5. Technician removes a batch of partly assembled semiconductors from electric oven which bakes out thermosetting gold paste used to join lead wires to the crystals.

electroplated to assure a good rectifying junction. Then in an assembly room, the dice are attached to lead wires already inserted in one end of the glass envelope of the semiconductor. In the process, the operator picks up one of the dice crystals with a small vacuum quill and applies a gold thermosetting paste to the side in contact with the lead wire. Next the crystal is centered on the lead wire inside the envelope, and mechanical pressure is applied to secure the crystal and wire.

Final bonding takes place in curing ovens as the gold paste heats up. One of the ovens appears in Fig. 5. At the moment, a batch of semiconductors on a holding block is being removed. The oven has a stainless-steel lining to guard the work from contamination by the heating element.

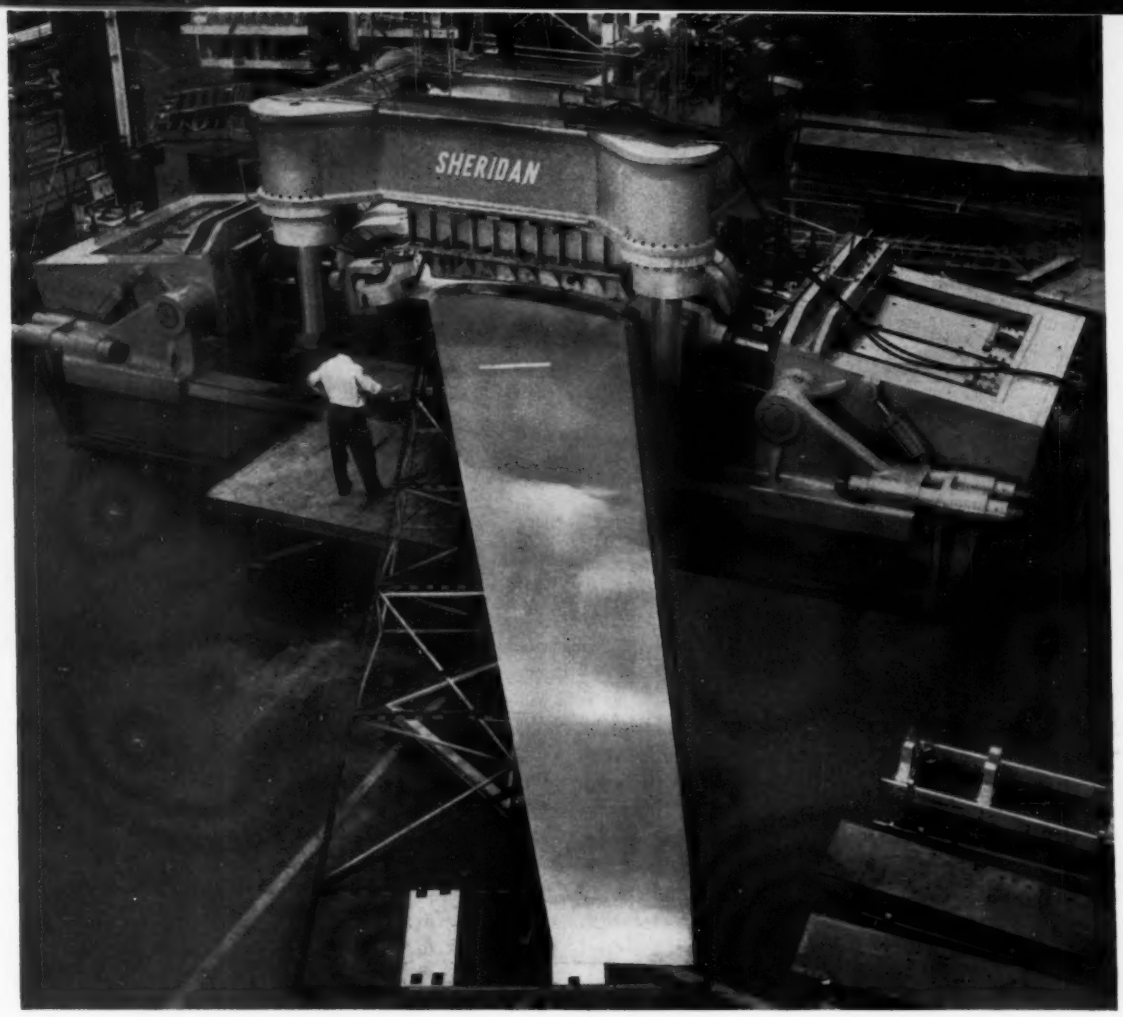
Using binocular microscopes and aligning jigs, operators spot-weld the ends of cat whiskers to the ends of the lead wires. These wires are then tinned to within 1/16 inch of the envelope, to facilitate soldering of the semiconductors into electronic circuits. For the diodes supplied in the glass envelopes. assembly is now about completed.

A company-designed machine automatically orients the diodes so that all cathode ends point in the same direction. They are then run through a striping machine where the envelopes are color-coded as to type and polarity.

The semiconductors reach the customer in the form of a tape wound around a drum. Tapes are used in automatic electronic assembly operations, in which an inserting device fits the semiconductors into the proper spot in the circuit. In the heading illustration, the inspector makes a final check on the taped semiconductors. Red stripes designate cathode ends. An earphone test assures that semiconductors are properly oriented.

Transistors and power rectifiers furnished in metal cases follow a different procedure. Here, three leads are attached to the crystal, which is then placed in the bottom half of the case, and finally caps are added, as can be seen in Fig. 6. This assembling operation takes place inside a hood, to keep out dust and moisture.

Fig. 6. In transistor assembly, crystals with attached leads are placed in metal cases and capped. Assembler uses dental mirror to guide her. Later, case halves are crimped together by machine, leads are inserted, and cases are sealed.



STRETCHING the Wings of a DC-8

O. L. RUMBLE, Tooling Manager
Long Beach, Calif., Plant of
Douglas Aircraft Co., Inc.

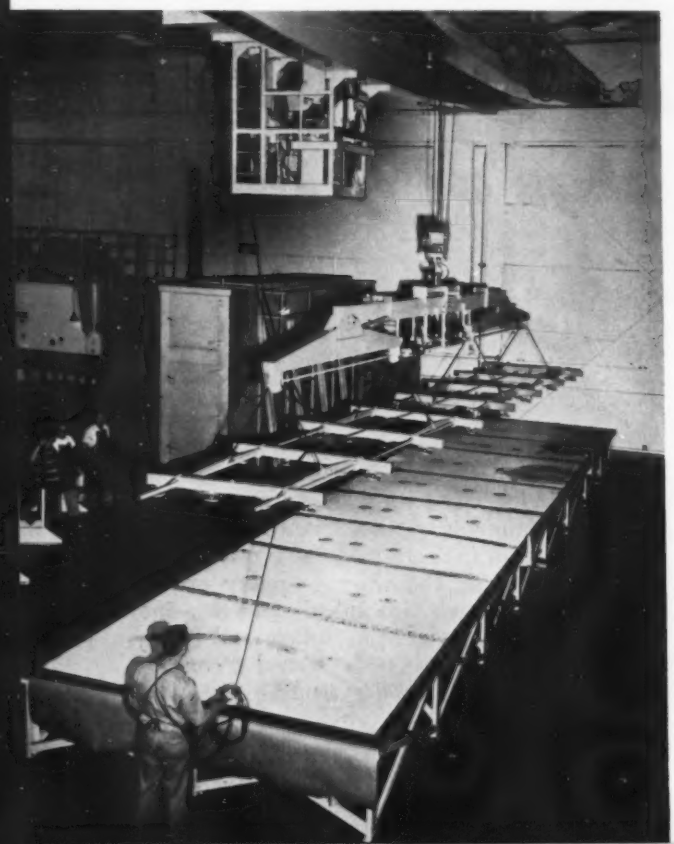
THE DC-8 JET-LINER, forthcoming contribution to civilian jet aviation by the Douglas Aircraft Co., will fly on king-sized wing sections of single-piece construction. A huge 600-ton Sheridan press measuring 20 by 36 by 20 feet high—the largest stretch press in the world—is used exclusively to contour the dihedral break area of the skins for the wings. Designed to Douglas specifications, the unique press stretches the 10- by 46-foot tapered aluminum sections with a four-directional pull.

During the early engineering design, a number of alternate concepts were considered for construction of the DC-8 wing. These were splicing the wings at the intersection of wing and a wing-constant section (a section having no sweepback angle); continuing the wing geometry—specifically the sweepback and dihedral angles—into the fuselage for a center-line splice; and finally, forming the intersection of wing and a constant section into the skins and extending them to a center-line splice.

Fig. 1. (Right) Large tapered aluminum sheet for a wing skin is packed in dry ice to suspend the age-hardening process during the week-long trip to California.

Fig. 2. (Below) After removal from storage in a special refrigerator, the wing plate is placed on the layout table. Rotatable handling fixture above the plate has vacuum cups for lifting.

The latter design involved a contour-forming job in eight 10- by 46-foot wing skins required for the DC-8 wings, but offered the optimum weight-strength ratios and proved to be the most efficient in obtaining the necessary fatigue life, so important to the commercial airline operator. After much experimentation and reduced scale testing of various forming methods, the decision was to design and build the new four-directional stretch press shown in the heading illustration.



Design, construction, and installation of the mammoth press, which weighs 700,000 pounds, were completed in the record time of 140 days. The press has a 96- by 110-inch die table which is mounted on a lower ram of 450-ton capacity. A separate overhead unit with four cylinders of 600-ton capacity each operates two pads which are used to restrain the material outside of the desired stretch area. Two pairs of jaw units, one pair on each of two opposite sides, are mounted independently at the edge of the die table. The jaws are actuated by eight 150-ton capacity cylinders, two of which are fastened to each jaw by a clevis which permits the angle of pull to be varied. This allows the jaws to conform to the sweepback and dihedral angle of the skin.

Aluminum sheets from which the skins are cut are rolled on the world's largest tapered-sheet mill located at the Davenport, Iowa, works of the Aluminum Company of America. The 1200-pound skins are tapered longitudinally from 0.210 to 0.130 inch. Rolled from an age-hardening aluminum alloy, the skins slowly become harder and stronger if kept at room temperature.

Normally the slowness of the hardening process allows the sheet to be machined and worked while soft. In the case of the skins for the Jet-Liner, however, the tapered sheets must be kept from aging during the week-long trip from Iowa to California. To solve this problem, Alcoa suspends the aging process by packing the aluminum sheets in dry ice (Fig. 1) for a sub-zero, cross-country ride. On arrival at the Long Beach, Calif., plant, the sheets are unloaded from the refrigerated railroad cars and placed in a custom-built icebox until ready for the fabricating operations. Refrigeration at 20 degrees F. aids in maintaining the aluminum in proper condition for stretching.

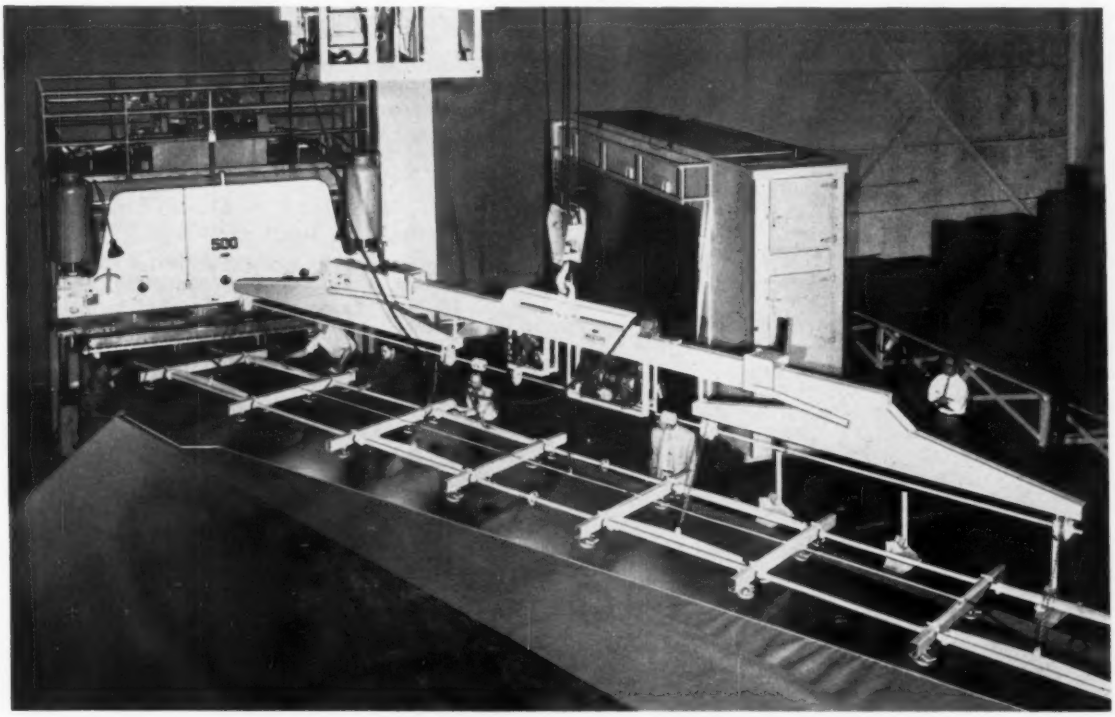
Fig. 3. (Right) Here the shape of the wing skin is laid out on the huge longitudinally tapered aluminum plate which is 10 feet wide and 46 feet long. Each plate weighs about 1200 pounds and tapers from 0.210 to 0.130 inch.

Fig. 4. (Below) Before stretching, the dihedral angle is preformed into the skin with a special die on a large hydraulic press brake.

The skins are removed from the icebox as required, placed on a padded layout table (Fig. 2), and then trimmed by guiding a Skilsaw equipped with a carbide blade around a full-scale template. Layout of a wing skin on a tapered aluminum sheet is shown in Fig. 3.

A partial preform of the dihedral angle is then accomplished by means of a special die on a large hydraulic press brake (Fig. 4). Transportation to the huge Sheridan press is by a special handling fixture. The root end of the skin is placed over a large 10- by 12-foot die and is positioned to match the dihedral angle of both die and skin. A separate die is used to shape each of the eight formed wing skins required for the wings of a DC-8. The end of the skin, extending beyond the press, is supported by a lightweight fixture.

The lower ram of 450 tons aids in raising or lowering the die to the proper position prior to



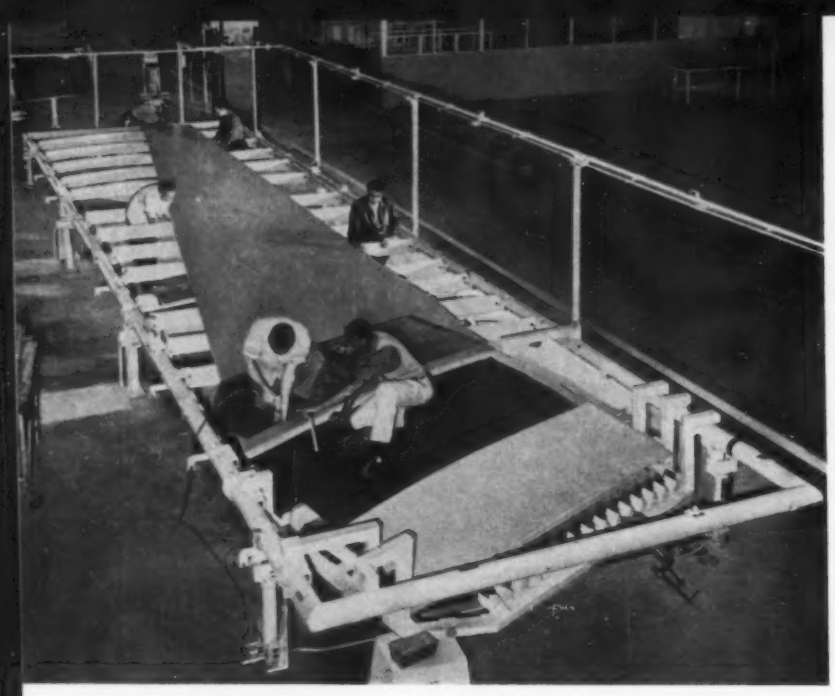


Fig. 5. Retention pads are down on the part and stretching operation is under way. Jaw units are retracting at a rate of 6 inches per minute.

the start of the stretching operation. First two 300-ton jaw units on each side move in and grip the skin on the forward and aft edges. Two retention pads, one on each side of the dihedral area, are then lowered onto the skin, and an applied pressure of 1200 tons effectively sandwiches the skin between the die and the pads. This prevents movement of the material which normally takes place at a right angle to the direction of pull during a stretch operation. Finally, with all units in position, tension is applied to the jaw cylinders and the skin is stretched chordwise in the dihedral area until a permanent set in the material is obtained. A skin in the process of being stretched is illustrated in Fig. 5.

An unusual feature is the use of an intercommunications system consisting of five microphone and headset units worn by the operator and his assistants to facilitate control of the large stretch press. Upon removal from the press, the skin is finish-trimmed in the area that was gripped by the jaws. A number of additional operations and tests are required to ready the skin (Fig. 6) for the assembly line.

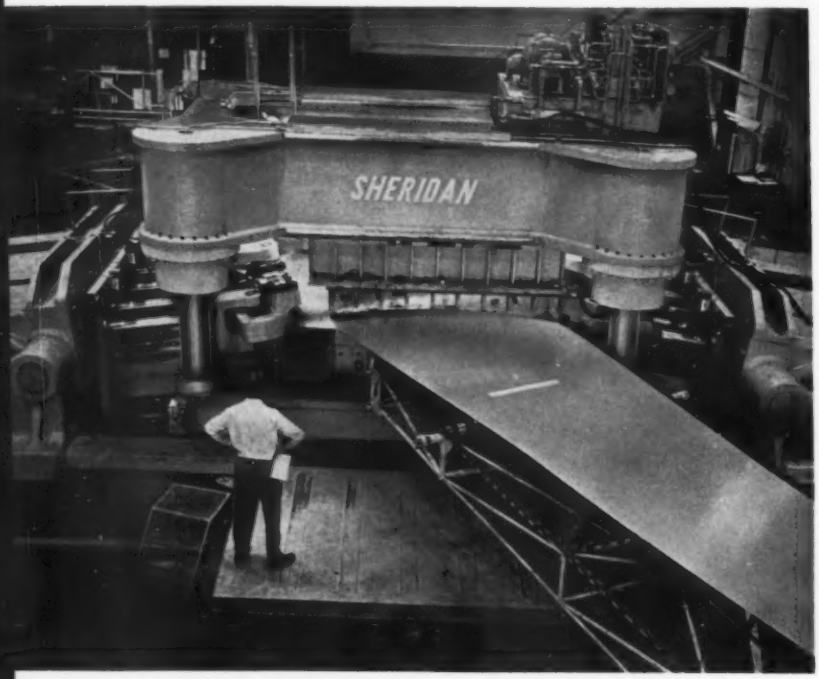


Fig. 6. On completion, the wing skin is prepared for assembly operations. Stretched area (foreground) joins the swept-back section at the dihedral break.

FORD Discloses New Template-Making Method

A NEW METHOD for making templates at the Canton, Ohio, Forge Plant of the Ford Motor Co. shows a dollar savings as high as 50 per cent. Key piece of equipment is an optically controlled filing machine.

The templates are indispensable to the forging procedure. In the die shop, undersize templates check machining operations on forging dies being made, and full-size templates check the final polishing of the dies at the bench; in the die inspection department, templates are used to check wear conditions; and at the forging presses, oversize templates check the work while hot, and basic-size templates check it when cold, thus indicating its shrinkage.

Over 8000 templates are kept in inventory, of which some 3000 are made or revised yearly. All Ford forging production is concentrated at Canton, and die-making is on a mass-production scale. As many as 600 of one particular die will be made in a year.

Template material is ground gage stock, from 1/16 to 3/8 inch thick, depending on die size. The thinner material is prehardened to 30 Rockwell C, to avoid distortion after machining. This is not a factor with the thicker templates, which are hardened after machining to 50 Rockwell C. Many of the larger templates used at the forging presses are provided with steel knurled handles riveted to each end, for the user's convenience.

The old established method for making a typical template starts by bluing the gage stock and laying out the pattern from the drawing. Rough stock is removed with a band saw, then on a butterfly filing machine the form is finished to the scribed outline. A careful inspection of all dimensions completes the operation. If the die involved requires more than one template (gen-

Fig. 1. Scriber point cuts a 0.004-inch wide line through the emulsion coating of the reticle. On filing machine, line will be magnified to 0.080 inch.

erally the case), the same procedure has to be repeated. Frequently, the initial template becomes a master from which the other templates are laid out. This is a quicker procedure than laying out each one from the drawing.

By contrast, in the new method, the initial step consists of laying out the drawing pattern on a plastic-coated sheet called a reticle. This is done on a Cincinnati Projecto-Form scribing machine, Fig. 1. The reticle (Stabilene G 1334) is 0.0075 inch thick, consisting of a 0.0055-inch transparent Mylar base and a 0.002-inch opaque-emulsion coating. It is secured with masking tape to the machine table.

Actual scribing is done by a carbide point (30-degree included angle) cutting through the 0.002-inch coating. Width of the lines scribed is 0.004 inch. The scriber is supported in a carriage which can slide across a vernier. In turn, this assembly can slide over a second vernier at 90 degrees, thus giving the scriber accurate movement in coordinate directions. For scribing sloping lines, the table, which is circular, is first rotated. Its angular position is set by a third vernier.

Next the reticle is mounted on a shadow box, Fig. 2, and dimensions and arrowheads are scribed manually. Also, scribed lines are inspected with an optical scale. For all practical

Fig. 2. Dimensions and arrowheads are added to the reticle by hand while it is held on a shadow box. Technician also inspects scribed lines here.

Fig. 3. The operator employs coordinate movements of cross-feed and long-feed handwheels to present the scribed line to the file.

purposes, the reticle can now be considered a master template: It can be used repeatedly to make the actual steel templates, and it can be stored readily, occupying little room in an ordinary file cabinet.

To make a template, the reticle and the steel work-blank are positioned on the filing machine, Fig. 3, built by Optical Gaging Products, Inc., Rochester, N. Y. Designed to permit filing under magnification, the equipment combines the optical principles of a contour projector and a vertical filing mechanism. Basic arrangement provides for mounting the work-blank in a horizontal plane on a movable table. Approximately 12 inches above the table is a glass plate supporting the reticle. The table can be moved longitudinally and transversely, so that the work can be guided against a small file which reciprocates vertically.

Between the work-blank and reticle is a box containing a prism beam splitter. This device picks up the images of the work-blank and reticle, combining and directing them through the projection optics in a housing in the rear. Images appear at any desired magnification on a screen directly in front of the operator. In this instance, a 20× magnification is employed, bringing the

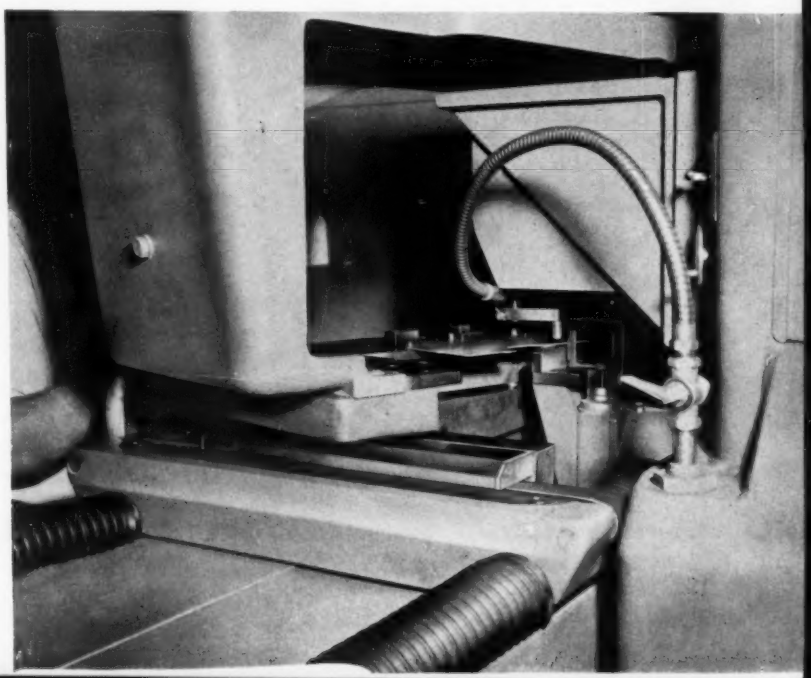


Fig. 4. This view from the side of the machine shows a radius being filed. The file is held in a C-frame having a cylindrical shank.

Table 1. Time Breakdown for a New Template

Operation	Old Method, Hours	New Method, Hours	Hours Saved
Layout	1.5	1.0	0.5
Sawing	0.5	0.2*	0.3
Filing	1.5	1.5	...
Inspection	1.0	0.1	0.9
	4.5	2.8	1.7

* Rough round-file time

Table 2. Time Breakdown for a Replacement Template

Operation	Old Method, Hours	New Method, Hours	Hours Saved
Layout	1.5	...	1.5
Sawing	0.5	0.2*	0.3
Filing	1.5	1.5	...
Inspection	1.0	0.1	0.9
	4.5	1.8	2.7

* Rough round-file time

scribed lines of the reticle up to a width of 0.080 inch. Since the reticle moves in unison with the work-blank, a relatively small-screen optical system can accommodate templates of large size (up to 6 inches wide and 20 inches long).

The table can be moved simultaneously in and out and lengthwise by two handwheels. Or, a combination of an automatic long feed with a manual cross-feed can be applied. To follow a line scribed at some angle, the table can be offset up to 30 degrees in either direction. For filing radii, the feeds are locked out and the table is pivoted. Fig. 4 is a close-up view from the right-hand side of the machine, taken while a radius was being filed.

No band-sawing is involved in the new method. Instead, the profile is rapidly roughed out with a round file, then finished with either a square file or thin file. Each file is supported in a C-frame holder having a cylindrical shank which is held in a spring collet in the machine. Four of the holders and one of the templates are illustrated in Fig. 5.

Approximately one-half of the plant's templates are now made from reticles on the optical filing machine. In Table 1 is a comparison of the template-making time for the two methods. Although filing time for both is the same, the use of the optical filing machine in the new method produces substantial savings in related operations.

There are even greater savings realized when an existing template has to be replaced, as is shown in Table 2. In the old method, the replacement template still has to be laid out, but in the new method, the reticle is already available. Another advantage of the new method is that it can be used to salvage a worn template. It is a simple matter to put the template back on the filing machine table and, using the original reticle, to refile the working edge.

Fig. 5. Four of the files and their holders. Shanks of holders are interchangeable in collet of machine. Template seen in illustration is provided with handles because of its large size.

How to Improve Your Cylindrical Grinding

Basic factors that influence cylindrical grinding are defined, and experimental data are used to show how a change in any of these factors alters the end product of the operation.

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Carborundum Company, Niagara Falls, N. Y.

CENTER TYPE cylindrical grinding is unusually comprehensive in scope. It includes such extremes as grinding a jeweler's roll to a mirror-like finish and grinding a crankshaft from a rough casting. Obviously, these widely different operations require different grinding techniques. However, because both operations are performed on a center type grinding machine, they do have a number of factors in common.

In any grinding operation, the basic considerations are the abrasive wheel, speeds and feeds of the machine, condition and capacity of the machine, and the grinding fluid. The performance of an abrasive wheel can be altered considerably by the speeds and feeds at which it is operated. For cylindrical grinding the basic operating factors are:

Traverse Speed—Speed at which the machine table travels back and forth in inches per minute

Work Speed—Speed at which the part revolves on its own centers in surface feet per minute (sfpm)

Width of Cut—Distance the table advances for each revolution of the work

Infeed—Distance the work is fed into the wheel in 0.001 inch measured on the diameter

Run-Off—Distance the wheel is permitted to run off work at end of each pass.

Speed and Feed Considerations

Traverse speed of the table determines the production rate. The faster a work-piece passes across the face of the wheel, the more metal is removed in any given time. What happens to wheel performance when changes are made in the traverse speed is shown in Fig. 1. These graphs show the grinding efficiency: the volume of metal removed divided by the volume of wheel loss for a range of wheel gradings. The graphs are for work speeds of 35 and 70 sfpm. Two work speeds are shown simply to indicate that the effect of a change in traverse speed is fundamental and not limited to a specific set of grinding conditions. All data for the graphs in Figs. 1, 2, 6, and 7 are for aluminum-oxide wheels made with No. 465 grain-size abrasive using a vitrified bond. Steel used in these tests is SAE 4142, hardened to 41 Rockwell *C*. An oil-water emulsion was the grinding fluid.

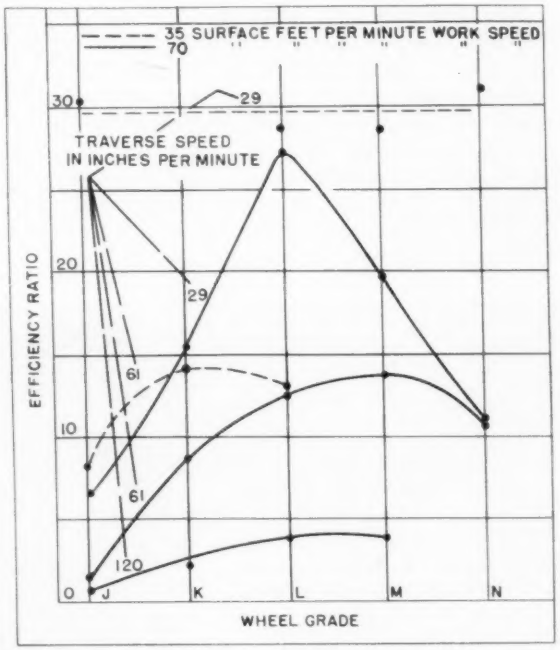


Fig. 1. Increases in traverse speeds cause lower grinding efficiencies and require a harder wheel grade for optimum results. In all tests, material of work-piece, wheel construction, and grinding fluid were the same.

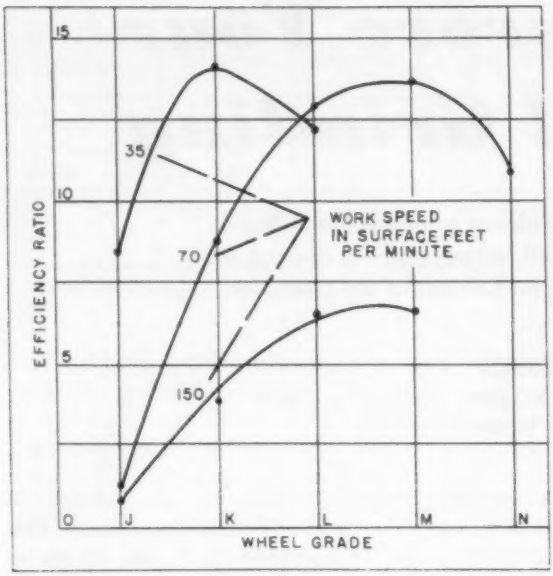


Fig. 2. Plots are for a metal-removal rate of 0.56 cubic inch per minute. As with higher table speeds, higher work speeds cause the wheel to break down faster and require that a harder wheel grade be used for optimum grinding efficiencies.

In effect, Fig. 1 indicates that an increase in traverse speed produces lower grinding efficiencies. Higher table speeds break the wheel down faster. The graphs in Fig. 1 also show that the effect of a change in wheel grade is less critical at slow table and work speeds. In everyday grinding, a variety of jobs can be done with one wheel, provided the table speed is slow enough. This is pertinent to job shops that do a variety of short-run work. In such shops, a majority of the work can probably be done by selecting a general-purpose wheel and adjusting the table speed to suit the job.

When the table speed is too fast, all wheels tend to break down in the same degree and the difference in wheel grade becomes lost. As the traverse speed is increased, abrasive cost is also increased. It is evident from Fig. 1 that there is a wheel grade providing optimum abrasive efficiency for each traverse speed. As the traverse speed is increased, a harder-grade wheel becomes the optimum one. The sooner wheels break down, the harder it is to maintain size and finish.

Thus, traverse speed substantially controls grinding wheel performance and the effects can be summarized as follows: faster traverse speeds break the wheel down more rapidly, make size more difficult to maintain, produce poorer finishes, and require harder-grade wheels for optimum grinding efficiency. Conversely, slower traverse speeds maintain wheel form longer, increase wheel efficiency, promote closer size control, produce better finishes, and permit the use of softer-grade wheels.

Work speed, unlike traverse speed, does not directly affect the metal removal rate, but indirectly will alter the depth of cut taken by the wheel. The effects of three different work speeds on grinding efficiency are shown in Fig. 2. In each case, the wheel was grinding at the same metal-removal rate, and therefore work speed was the only variable in the grinding process at the time. It is evident from the graph that an increase in work speed produced lower grinding efficiencies and, in general, the results paralleled those of an increase in table speed. Faster work speeds, therefore, break the wheel down more quickly and require the use of harder-grade wheels for optimum grinding efficiency.

The width of cut taken by the wheel is particularly important in the production of finishes. The width of cut equals the traverse speed in inches per minute divided by the rotational speed

Fig. 3. To measure width of cut, hand is steadied on wheel guard or coolant nozzle and rotating work-piece is marked with pencil while table is moving. A small width of cut (left) is used for finishing and a large one (right) for roughing.

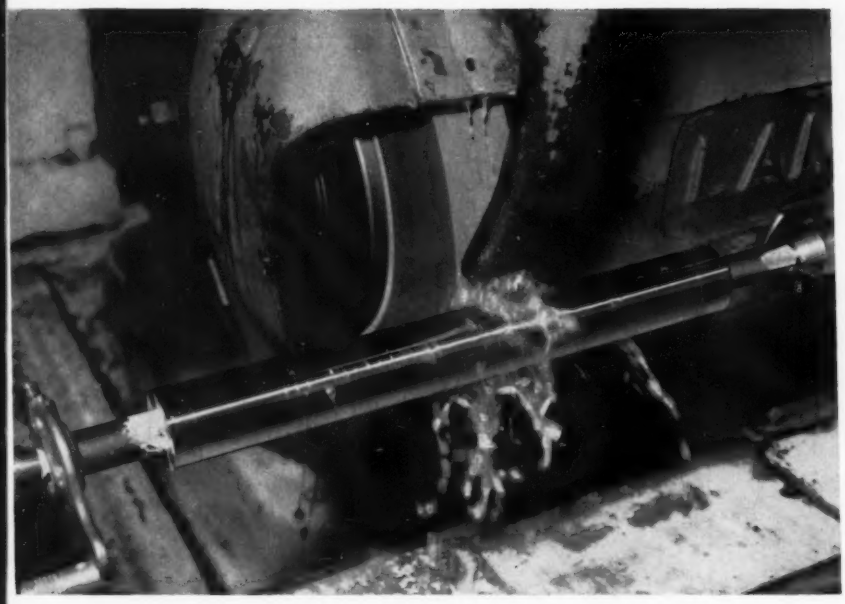


Fig. 4. This casehardened roll is being ground to a 2- to 3-micro-inch finish. Wheel abrasive is No. 80 grain size held in a vitrified bond.

of the work in revolutions per minute. Obviously, the width of cut will be increased by an increase in traverse speed or a decrease in work speed and conversely, will be decreased if the traverse speed is decreased or if the work speed is increased. To measure the width of cut, a pencil is simply held against the work, steadying the hand on the wheel guard, and permitting the work to rotate and traverse as it does during the grinding operation. A scale is used to measure the advance in one revolution. In addition, this method, illustrated in Fig. 3, can be used to quickly and easily adjust the cut to the desired amount without altering the setup or performing any computations. The difference between a wide and narrow cut is also seen in Fig. 3.

To generate a good finish it is common practice to use a small width of cut. This is done by reducing the traverse speed and increasing the work speed. A finish produced with an 80-grit wheel operating at a slow traverse speed and a fast work speed is shown in Fig. 4. A typical roughing cut using a fast traverse speed and a slow work speed is illustrated on the work-piece in Fig. 5.

Decreasing the width of cut essentially provides a larger area of the wheel for cleanup, and therefore a finer finish is the result. A better finish can be generated by an increase in work speed simply because, in the first place, finish-grinds are generally performed by light infeeds that do not stress the wheel to any great extent. In the second place, the traverse speed is decreased, an adjustment which again tends to maintain wheel form and prevent breakdown. The net result is that the slow traverse speed plus the smaller

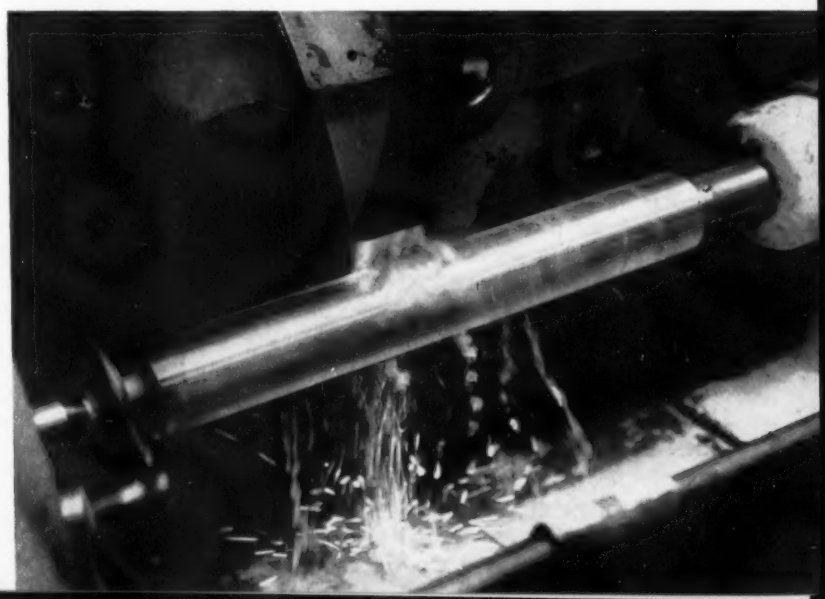


Fig. 5. Here is shown a typical roughing operation. Table traverse speed is fast, infeed is heavy, and surface speed of the work is slow.

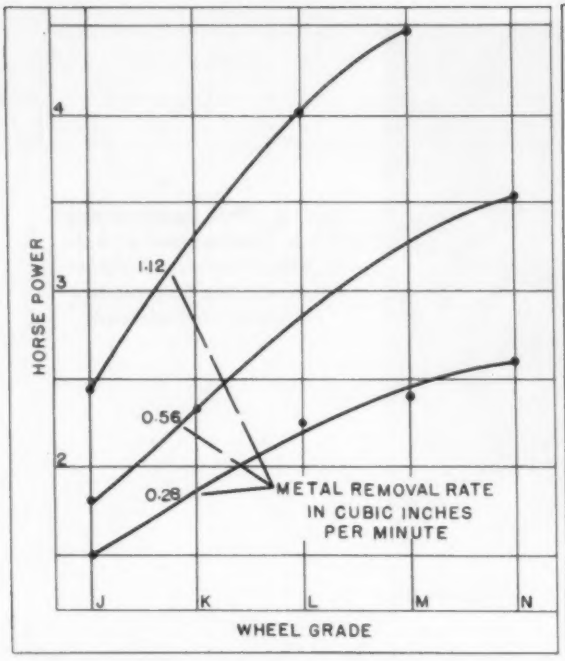


Fig. 6. A harder-grade wheel requires more power than a softer one to remove metal at the same rate. Insufficient power limits choice to softer wheels.

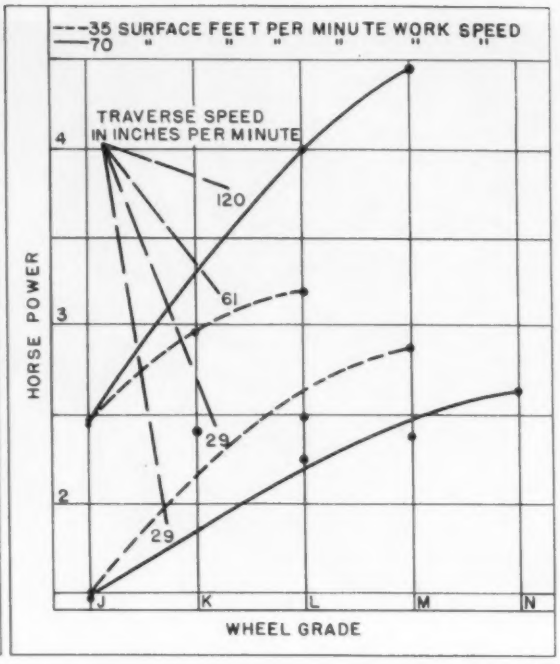


Fig. 7. More power is required when the traverse speed is increased, since the metal-removal rate (or work rate) is also increased.

width of cut in addition to the light infeeds overcome the effect of an increased work speed and generate a better finish.

Low Spindle Power Increases Grinding Costs

The amount of power available at the spindle is important and critical in any grinding operation because it controls the production rate and limits the choice of the abrasive wheel. If there is not adequate power available, only the softer grades of grinding wheels can be used. Grinding efficiency is thus penalized, and the operation becomes more costly than necessary.

Power required by a range of wheel gradings during each of three operations that removed metal at rates of 0.28, 0.56, and 1.12 cubic inches per minute is shown in Fig. 6. These graphs clearly indicate that a harder-grade wheel required more power than one of a softer grade when removing metal at the same rate. The J-grade wheel removed 0.28 cubic inch of metal per minute with 1.50 hp while the harder N-grade wheel, removing metal at the same rate, required 2.64 hp. However, Fig. 1 shows that the grinding efficiency for the J-grade wheel was 6.6, but the harder, N-grade wheel, operating under the same conditions, had an efficiency that was practically double. Harder-grade wheels consume more power than those of softer grades, and consequently, insufficient available power at the spindle limits the choice of the grinding wheel to a softer grade which ultimately increases the cost of abrasive to do the job.

Supplementing the information given in Fig. 6, the power needed for various grades of wheels at different traverse and work speeds is shown in Fig. 7. Evidently, operating at a faster traverse speed takes more power than when a slower traverse speed is used. Wheels operated at faster traverse speeds remove metal at a faster rate, do more work per unit of time, and therefore require that more power be supplied to the spindle of the machine.

Cylindrical grinding with infeeds at both ends of the work generates a surface on the wheel face that is low at both edges and high in the center. If, however, the wheel is run off the work only a small amount, the infeed becomes virtually a plunge cut. This plunge cut will then be made with a wheel face on which the high-center low-edges contour has been generated. The effects of this grind are as follows: First, the high portion of the wheel face would grind deeper than the low portions and thus destroy the dimensional accuracy of the work. Second, the favorable contour on the wheel face would be de-

Some Basic Principles of Cylindrical Grinding

1. Fast traverse speeds produce fast stock-removal rates
2. Slow traverse speeds produce slow stock-removal rates
3. Increased traverse speeds cause the wheel to break down faster, produce a rougher finish, and make size control more difficult
4. Increased infeed rates results in faster stock removal rates, lower grinding efficiencies, and rougher finishes
5. For roughing grinds, use fast traverse speeds, heavy infeeds, and slower work speeds
6. For finishing, use slow traverse speeds, light infeeds, and faster work speeds
7. Maintain adequate power at the grinding spindle
8. For hard materials, use soft-grade wheels
9. For soft materials, use hard-grade wheels
10. For hard materials, use fine-grit wheels
11. For soft materials, use coarse-grit wheels
12. For grinding large areas, use soft-grade wheels
13. For grinding small areas, use hard-grade wheels
14. Use the largest wheel, both in diameter and in width, that is consistent with the size of the part to be ground.

stroyed. Therefore, the runoff should be such that the wheel remains on the work for only the distance of the width of cut at the end of each traverse. However, runoff should not be less than one-quarter of the width of the wheel face.

Machine conditions contribute greatly to the performance of the grinding wheel. Spindle bearings, machine foundations, traverse ways, vibrations produced by other machines in the immediate area—all influence the quality of the finished grind. In general, vibration causes a wheel to break down more rapidly, making size and fine finishes more difficult to obtain. Consequently, where vibration is present, a harder-grade wheel is necessary for satisfactory operation, but such wheels require more power and limit the work capacity of the machine. As any worn part in a machine can cause vibration, machines kept in good condition can contribute to satisfactory grinding.

The grinding fluid used in cylindrical grinding operations serves to maintain the work at a uniform temperature, to lubricate the point of contact between the wheel and the work, to remove the swarf from the grinding area, and to assist the grinding wheel to produce a smoother finish whenever necessary. A copious supply of fluid is required at all times. Water-soluble oils in rich mixtures tend to produce finer finishes, while detergent type fluids tend to maintain a clean wheel face and permit the wheel to produce the results normally expected of its grit and grade. Where extremely fine finishes are required, a filter may be needed for the grinding fluid. Odor, ease of mixing, stability of emulsion, and rust-inhibiting properties are among the working characteristics that should be considered in selecting a grinding fluid.

A number of basic principles of cylindrical grinding are given in the accompanying list to promote a better understanding of the process and to help in the selection of a grinding wheel.

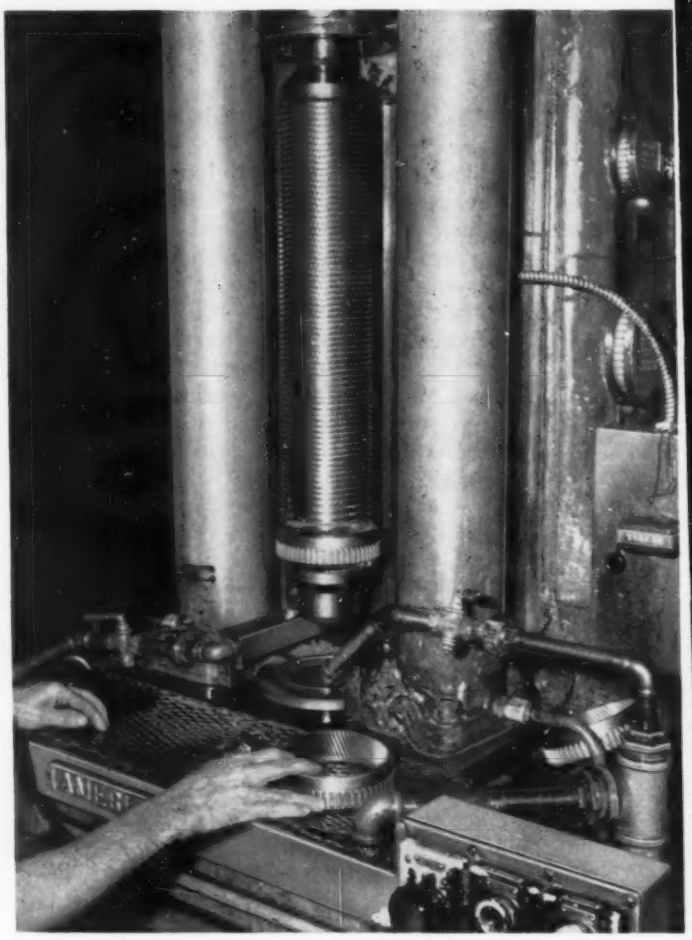
* * *

Sheffield Uses Atomic "Lamps" to Speed Precision-Measurement Research

New atomic-isotope tubes are being used as lamps to provide super-accurate light sources needed to help precision industries measure dimensions to millionths of an inch. The Sheffield Corporation, a subsidiary of Bendix Aviation Corporation, recently received two Krypton 84 atomic-isotope tubes for the company's Eli Whitney Metrology Laboratory, Dayton, Ohio. The tubes, specially developed by West Germany's Bureau of Standards for the laboratory's use, create light sources of the utmost known precision and purity.

The atomic-isotope lamps will be used in an interferometer, an instrument that measures light wave fringes to accuracies of less than a millionth of an inch. The Sheffield Laboratory has for some time used a U. S. Bureau of Standards-developed isotope of mercury which has greatly refined and sharpened the visibility and measurability of light waves. Successful tests of light wave lengths from atomic-isotope light sources lead many metrology and atomic scientists to believe that atomically created light waves can eventually be adopted as the world's primary standard of length.

Broaching Internal Helical Gears



Broaches designed to cut internal teeth of involute helical form in automotive running gears must be of a high order of accuracy. Some shops broach gears and eliminate all subsequent tooth-finishing operations. This is made possible by utilizing precision broach manufacturing and inspection methods involving special machines and gages.

FRANK KIRSTEN
General Superintendent
National Broach & Machine Co.
Detroit, Mich.

SUCCESSFUL PRODUCTION of internal helical gears in the 6-inch pitch diameter and 14-diametral pitch range by the broaching process has been a significant achievement in reducing production costs. The gears can be rough- and finish-broached—and held to precision tolerances—without subsequent tooth-finishing operations.

A typical internal helical gear in this size range is being mass-produced by the broaching method to the following tolerances: circular tooth thickness, 0.001 inch; involute profile, 0.0004 inch; tooth-to-tooth spacing, 0.0005 inch; accumulated tooth-spacing error, 0.0008 inch; and lead, 0.0005 inch per inch of face width. The inside diameter of the gear blank is bored to a 0.004-inch tolerance prior to broaching. One automotive transmission plant is producing 5000 gears per day with a rough- and finish-broaching operation. Five broaching machines are used, as compared with the sixty-seven machine tools required by the conventional gear-generating method previously followed.

The key to the success of this type of gear-machining operation is, logically, the cutting tool—the coordination of design, manufacture, and quality control necessary to produce precision broaches up to 7 feet long and weighing up to 600 pounds. Special precision machine tools, heat-treating furnaces, and inspection equipment have been developed for producing solid broaches of the necessary size and accuracy.

Broach Requirements

A running-gear broach has two basic requirements: it must be accurate in tooth size, form, spacing, and lead; and it must provide maximum wear life.

Accuracy—Internal running-gear broaches must have involute forms. Since these are gears, and not straight-sided splines, the accuracy of involute form required for gears (plus or minus 0.0002 inch) must be produced by the broach. Circular-arc approximations, which simplify grinding-

wheel dressing methods and manufacturing problems, do not provide sufficiently accurate tooth forms for internal gears.

To insure maximum involute profile accuracy, the teeth are ground from the solid after the broach has been heat-treated. By performing the tooth-grinding operation at this point in the process, heat-treat checks that sometimes occur at the roots, as well as scale problems, are avoided. Another problem is encountered with broaches when the involute teeth are rough-milled in the soft state. Frequently, more stock is removed from one side than the other during the grinding operation after heat-treatment. This can be caused by index errors during rough-milling and by configuration changes during heat-treatment, with the result that one side of a tooth may end up softer than the other.

One advantage of the broaching process is the ability to modify the involute form on either, or both, the drive and coast side of the teeth. A precision master template in the wheel dresser on the special spline-grinding machine shown in Fig. 1 assures that an involute form of the desired accuracy or modification is faithfully reproduced on the grinding wheel.

Use of an involute form simplifies the checking of broach accuracy. If circular-arc approximations were used, the theoretically correct method of checking tooth size by measurement over pins could not be applied, and only approximations of insufficient accuracy could be used. With true involute forms, however, accuracy can be checked on a special Illinois involute-profile checking machine, Fig. 2, that utilizes a master base circle.

As with external gears, internal gears must be accurate in tooth spacing and helical lead. Uniformity of this accuracy from one part to the next is assured by the broaching method. Production of the broach lead during the spline-grinding operation must be accurately controlled. The grinding machine shown in Fig. 1 has a specially designed lead-bar arrangement that provides the required accuracy. The lead bar rotates the broach through a no-backlash drive while the splines are ground one at a time. Accuracy of the lead bar, as well as the lead of any tooth on the broach, is checked on a specially designed lead-checking machine in a soundproof, air-conditioned laboratory.

Spacing accuracy is achieved during spline-grinding by means of a high-precision automatic index mechanism. Accuracy of spacing is important in running-gear broaches because any such errors have the detrimental effect of reducing tooth thickness on the gear being cut, as do involute form errors.

Tool Life—Maximum wear life for running-gear broaches is assured by having uniform lands of maximum length. To make certain that the lands are accurately held, the tools are processed through a green inspection operation where land sizes are checked for length and uniformity. This added inspection places the land-turning operation under adequate quality control.

Being long and slender in shape, yet of con-

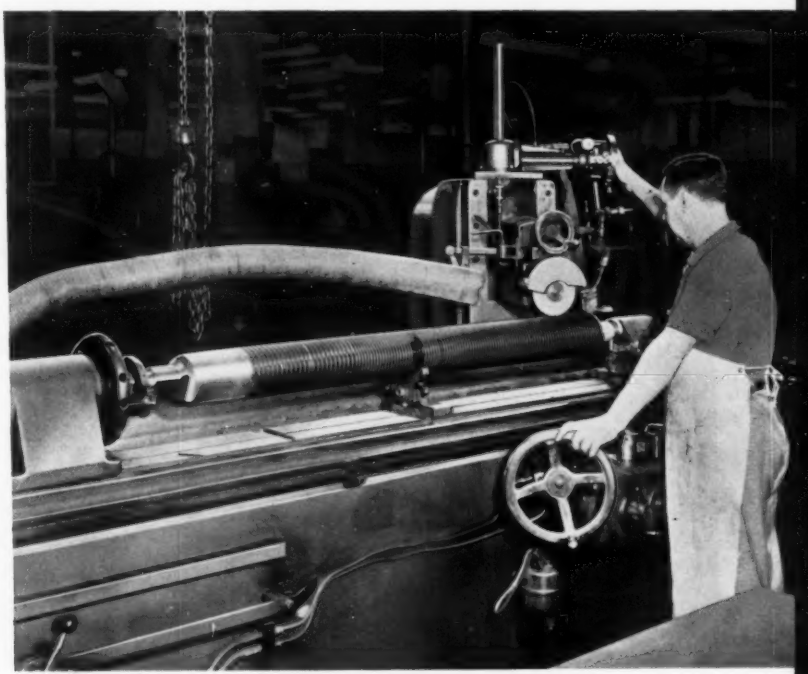


Fig. 1. Involute form of the desired accuracy or modification is ground in a solid, heat-treated broach blank. A precision master template in the dressing head maintains the proper grinding-wheel shape.

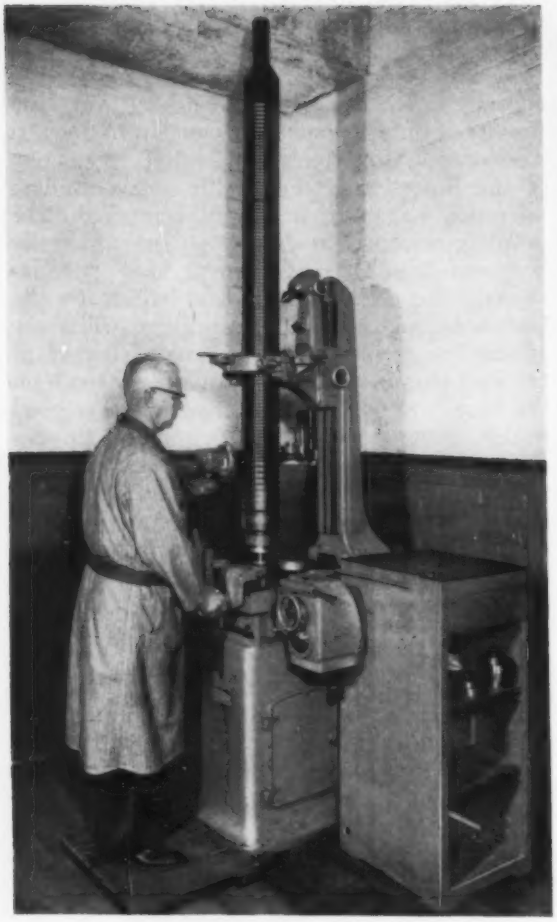


Fig. 2. One step in controlling broach quality is ascertaining the accuracy of the gear tooth shape. This is done on a special involute-profile checking machine using a master base circle.

siderable weight, the broach blanks require special heat-treating equipment and procedures. One problem is attaining a uniform hardness of 63 to 65 Rockwell C along the entire length of the blank. This is achieved by using both low- and high-heat deep-pit furnaces—each providing three individually controlled temperature zones.

Great care is exercised in straightening the broach blanks after heat-treatment. If straightening is done at the proper temperature, the broaches will remain straight during the subsequent grinding operations and throughout their useful life.

Material for running-gear broaches is selected like other high-speed steel cutting materials—for edge toughness, abrasion resistance, grindability, and heat-treatment characteristics. As a general rule, AISI Type T-1 hot-rolled steel bar stock having proper grain flow and carbide distribution is used.

Considerable improvement in broach life can be realized by using certain surface treatments. For example, the Naloy surface treatment minimizes side-loading of the teeth by providing a high skin hardness that resists abrasion and assures complete transformation of the broach material to an optimum martensitic structure.

Some manufacturers of internal running gears choose to broach the teeth to a semifinish dimension and then finish them on a rotary gear-shaving machine. In this case, clearance should be provided in the root of the semifinished gear teeth to accommodate the tip of the shaving cutter. This can be done in the spline-grinding operation by including the desired protuberance on the master involute-form template for the wheel dresser. Similarly, a chamfer on the tip of the internal gear teeth, which avoids nick problems, can be provided when desired.

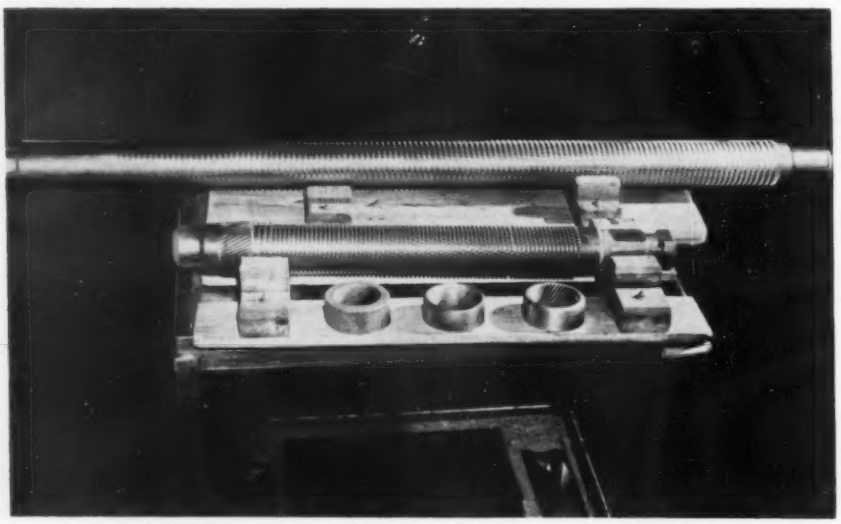


Fig. 3. Three production stages of a helical ring gear for an overdrive transmission. A roughing broach (rear) and a finishing broach (front) were used to cut the helical teeth in a two-pass operation.

Two-Pass Broaching Method Used for Internal Helical Gears

One of the most economical ways of producing internal helical gears is to employ a two-pass broaching method after which no subsequent tooth-finishing operations are required. This method, using Red Ring broaches, is employed by the Warner Gear Division of the Borg-Warner Corporation in the manufacture of automatic and overdrive transmissions for automobiles.

One of the ring gears for an overdrive transmission is shown in its various production stages, along with the roughing and finishing broaches that were employed to cut the internal teeth, in Fig. 3. The gear blank was machined from a steel forging before the rough-broaching operation. Two of these 42-tooth, 14-diametral pitch gears—having a pressure angle of 20 degrees and a helix angle of 27 degrees—are cut simultaneously on the two-station pull-down type American Broach machine shown in Fig. 4. Helical teeth are produced by rotating the broaches as they are pulled through the part. Rotation of the broaches is controlled by a single helical lead bar located forward of the cutters as can be seen in the illustration. The roughing broaches are about 6 feet long and 3 3/4 inches in diameter at their largest dimension. Involute forms on both tooth faces have different modifications.

Finish-broaching is done one at a time on a single-ram, American Broach push-down type machine. The operator slips the part over a helical gear guide that is machined on the front pilot portion of the 3-foot long broach (front, Fig. 3). A unique spring detent in this guide area holds the gear in place until it descends and is seated in the work-nest. The broach then passes through the gear and finishes the teeth. This assures accurate alignment between the rough-cut teeth in

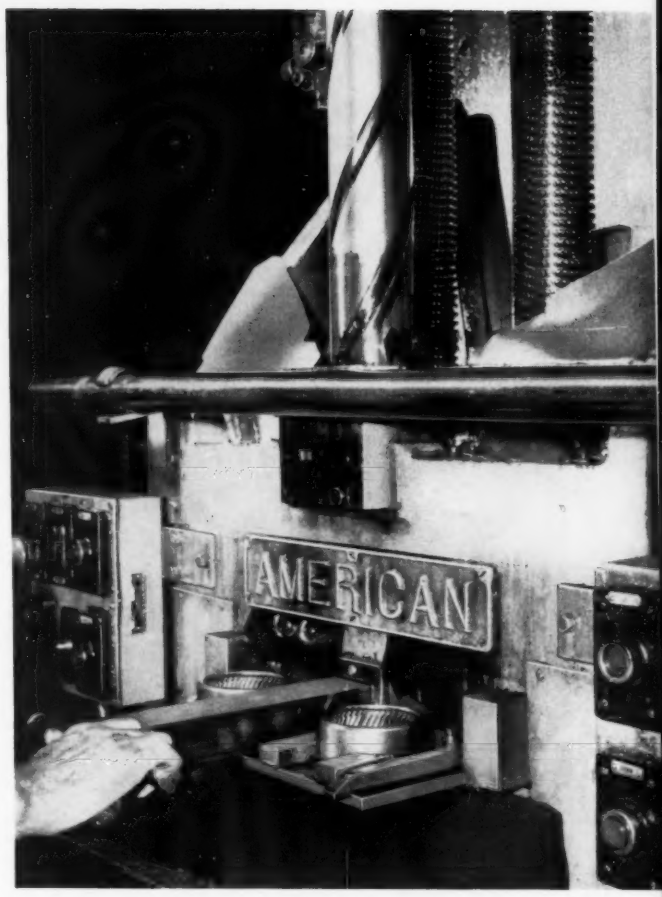


Fig. 4. Two of the 42-tooth, 14-diametral pitch ring gears (Fig. 3) are rough-broached simultaneously on this pull-down type machine. Helix angle is controlled by a single helical lead bar that rotates the broaches as they descend.

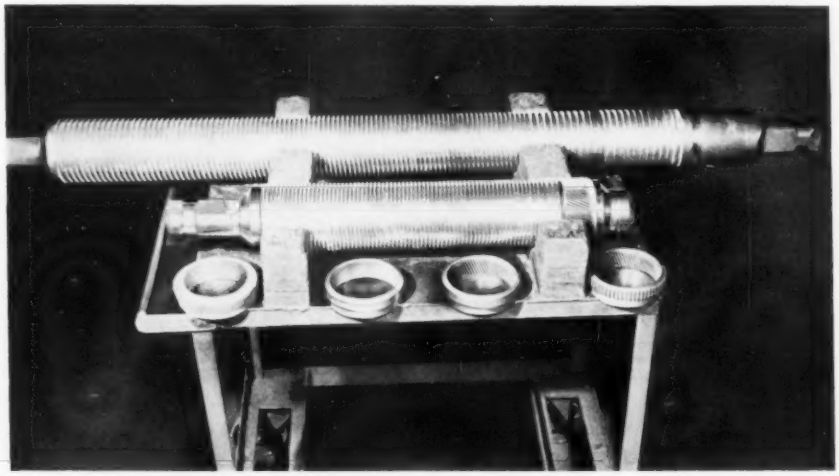


Fig. 5. A two-pass broaching sequence is used to cut 72 helical gear teeth of 15 diametral pitch in a ring gear for an automatic transmission clutch. The roughing broach is the longer of the two.

the gear and the finishing teeth on the broach.

Another internal helical gear being produced at Borg-Warner is the ring gear for an automatic transmission clutch. This part is larger than the gear already described—being 6 inches in diameter—and has spur gear teeth on its periphery. The 15-diametral pitch internal gear, which has 72 teeth, a 17 1/2-degree pressure angle, and a 22-degree helix angle, must be held concentric with the 59-tooth, 10-diametral pitch spur gear that has a pressure angle of 20 degrees. The roughing and finishing broaches used to cut the internal teeth, together with parts representative of the production stages from finished gear down to the initial steel forging, are seen in Fig. 5.

The rough-broaching operation is performed on two parts at a time on another two-station, pull-down type broaching machine. A helical lead bar again controls the rotation of both 6-foot long, 5 3/8-inch diameter broaches as they are pulled through the gear blanks. After this operation the gear is located from its internal teeth and the external spur gear teeth are machined on a Shear-Speed shaper. By following this procedure, a maximum amount of metal is removed from the ring gear prior to the precision finish-broaching operation, heading illustration, carried out on another single-ram, push-down machine.

A helical starting guide for the gear is provided on the pilot end of the 3-foot long finishing broach. The gear is retained in the guide area by a spring detent similar to that used on the overdrive ring-gear broach. Tolerances on the finished internal gear are held within close limits.

Effect of Slack-Quenching on Steels

An accurate method for measuring the effect of slack-quenching on the impact resistance of steel has been developed by the National Bureau of Standards. In the procedure, one end of a Charpy (V-notch) impact specimen is immersion-quenched to form a series of planes having different but predictable microstructures and hardnesses which depend on the distance of the planes from the quenched end. The depth of immersion and type of quenching medium used are predetermined from data obtained from an end-quenched Jominy specimen of the steel.

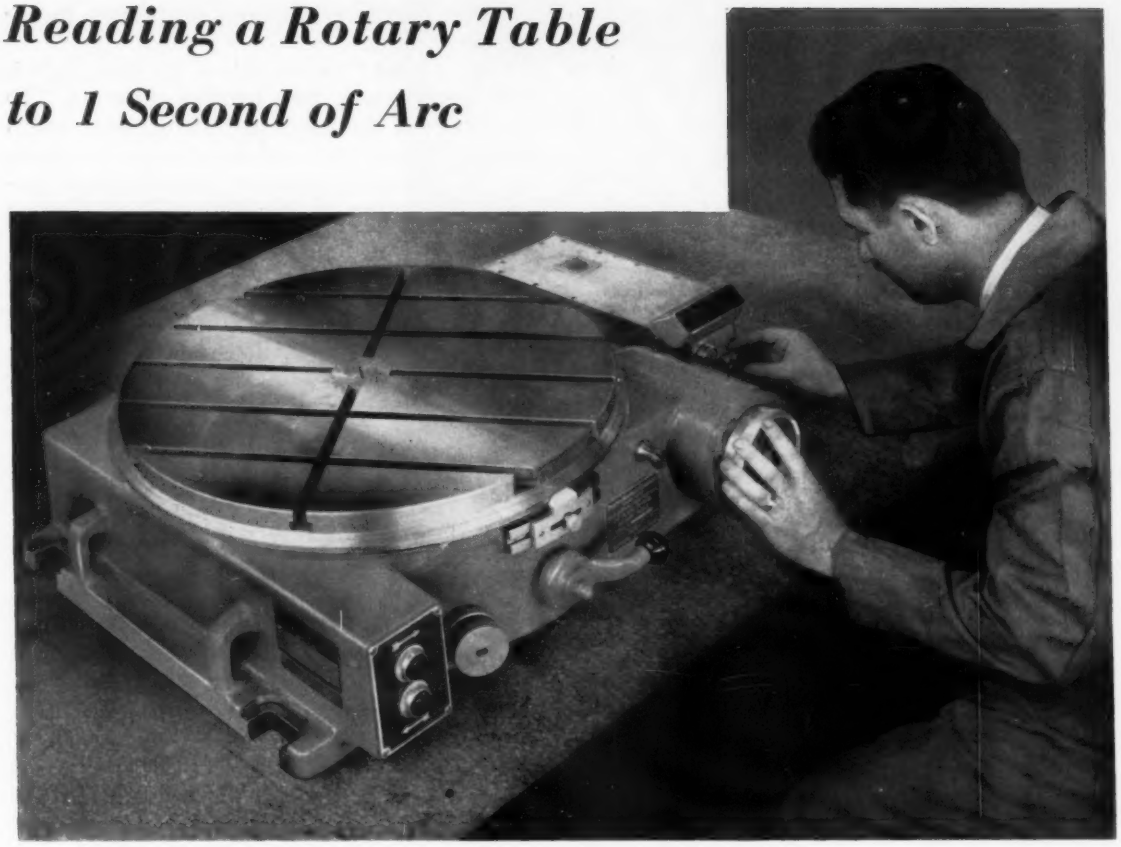
Until now little information on the properties of slack-quenched steels has been available. Consequently, manufacturers often substitute deep-hardening alloy steels for the less expensive carbon steels. Controlled slack-quenching should help to determine in what circumstances slack-quenched steels may be used. The new test method should lead to a broader understanding of how the impact properties of steels are affected by microstructural variations, and may save critical materials by reducing over-design.

It was reasoned that impact specimens having slack-quenched structures might be prepared in a manner similar to that of Jominy specimens. A Jominy specimen is hardened by a jet end-quench. In theory, the specimen contains an infinite number of parallel planes, and assuming no surface cooling, each plane is cooled at a constant rate that decreases with increasing distance from the quenched end. As a result, each plane has a different hardness and microstructure. A series of quenching and hardness tests were made on end-immersed impact specimens and Jominy specimens of the same steels, and the microstructure and hardness existing at selected distances from the quenched ends were correlated. The data obtained revealed a distinct relationship between hardness and structure at specific planes in the two types of specimens. This information has been reduced to graphical form for reference.

In studying impact properties of slack-quenched structures, a standard Jominy bar of the steel under investigation is first end-quenched according to ASTM specifications. A hardness survey along the length of the specimen is then correlated with the microstructures. Once the desired hardness or structure is located in the Jominy bar and the distance from the quenched end established, the graph may be used to determine how far an impact specimen should be immersed in brine to have the same hardness and structure at a position close to the center of the Charpy test piece.

After quenching, the specimens may require a low-temperature stress relief (250 degrees F.) to inhibit subsequent cracking. Then the specimens are ground equally on all sides to remove any scaling and decarburization that may have occurred. A hardness survey is made on one face to locate the desired slack-quenched structure, and a standard V-notch is cut into the specimen at that point. Finally, the ends of the specimen are cut off at a distance of 1.08 inches on each side of the notch. The impact resistance at that particular plane may then be determined by the Charpy impact test. Numerous hardness and metallographic surveys from center to surface of impact specimens (after removal of the decarburized layer) have established the uniformity of hardness and microstructure in any plane above the immersion level and parallel to the quenched end.

Reading a Rotary Table to 1 Second of Arc



AN OPTICAL ROTARY TABLE is giving ultra precision to jobs on jig borers and similar equipment requiring circular spacing or angular positioning. Used alone, the table provides new standards of accuracy for inspecting or calibrating. The table, made by Pratt & Whitney, West Hartford, Conn., embodies a Gurley UNISEC optical coincidence system and can be read to 1 second of arc, with an over-all accuracy of 3 seconds.

This coincidence system utilizes the principle of reading both sides of a circle at once, thus canceling any errors of eccentricity. The circle is a 10-inch diameter optically polished glass disc contained within the base of the table. (In Fig. 1 a table has been propped up on blocks, and a

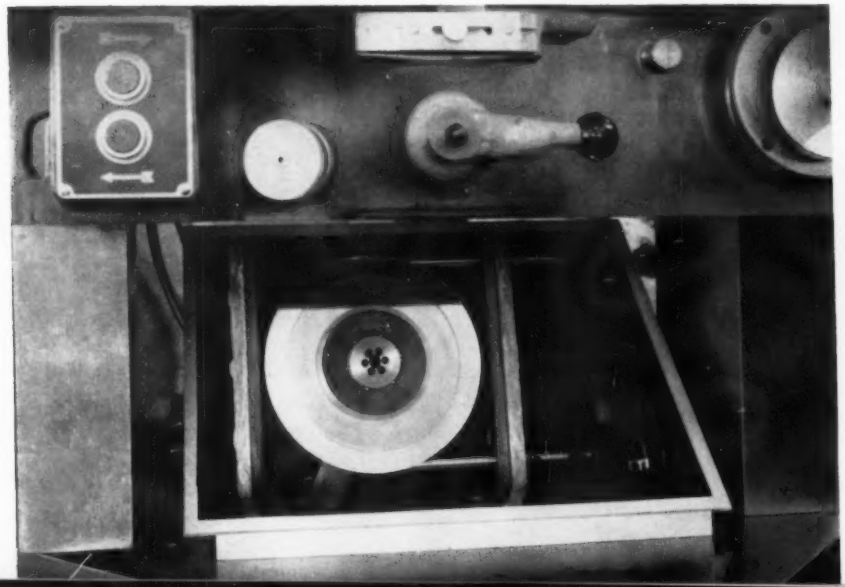


Fig. 1. The glass circle and the two projection tubes are reflected in mirror beneath base.

mirror placed at an angle beneath the base, to show the glass circle.) Both the table proper and the glass circle rotate together, being secured to a common vertical shaft.

As indicated in the diagrammatic representation, Fig. 2, the glass *A* is ruled near its rim with graduations *B*. The graduations are to 10 minutes of arc, and each degree is marked. (For clarity, only the degree graduations are shown in the drawing.)

From a lamp *C* in one side of the base, light is projected through two parallel tubes *D*. The inner ends of the tubes extend to points which are 180 degrees apart and directly over the graduations. The image of the graduations is projected back through the tubes. Then through

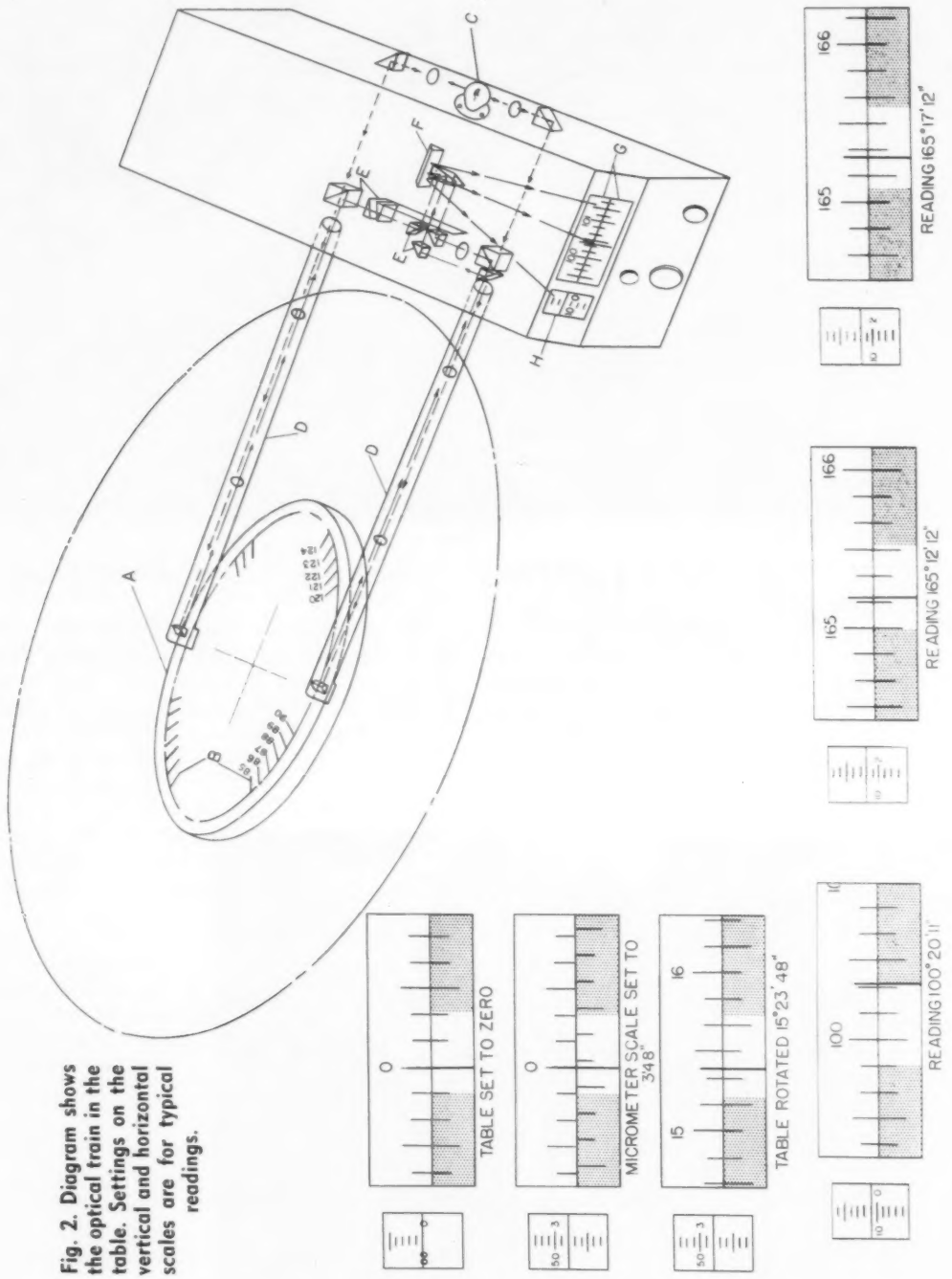


Fig. 2. Diagram shows the optical train in the table. Settings on the vertical and horizontal scales are for typical readings.

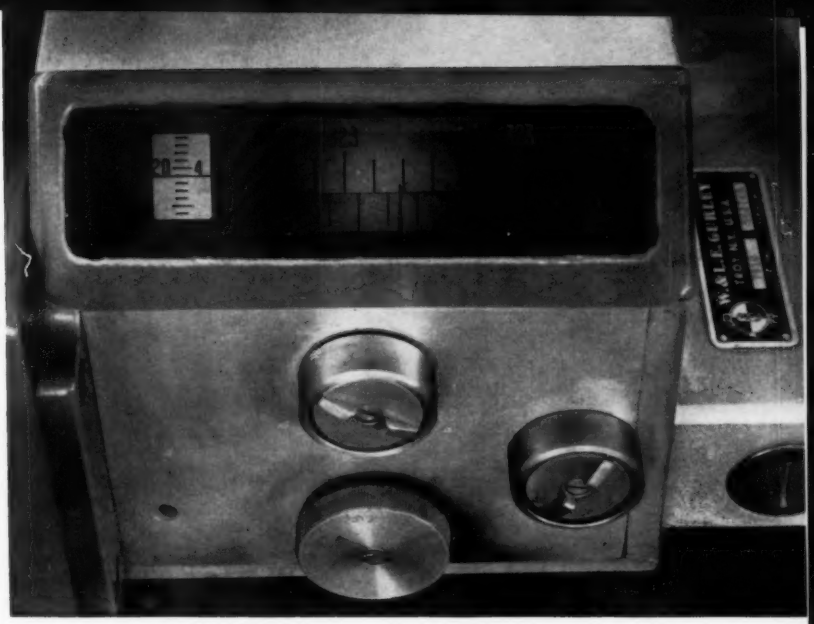


Fig. 3. Close-up view of window area of optical rotary table. Vertical scale is a 5-minute breakdown of one division of horizontal scales.

a series of prisms *E*, each beam of light is projected back onto a screen *F*, and the calibrations at opposite sides of the glass appear as two horizontal scales *G* in a window in the right front corner of the base. The heading illustration shows the worker looking in this window, and in Fig. 3 the window area is shown enlarged.

When the table is rotated, the two scales move in opposite directions. Since the glass circle is graduated in 10 minutes of arc, and since the images on the screen move in opposite directions, the graduations come into coincidence with each 5 minutes of rotation. Figures can be seen at each degree on the upper scale. Since figures on the lower scale would appear upside down, and since they would have no bearing on the reading, the mask of the window is purposely designed to hide them from view. An adjustable reference pointer reaches across both scales.

In the left side of the window can be seen a vertical micrometer scale *H*. This scale has a range of 5 minutes, graduated in seconds. It is used to break down the 5 minutes between the points of coincidence that appear on the two horizontal scales as the table is rotated. The optical system is so coupled that when the vertical image is moved, the lower horizontal scale moves in correct relation. No movement of the glass circle is involved in this adjustment. What happens is that a deviating prism in the line of projection to the lower scale shifts the position of the light beam from one side of the optical train.

There are 300 graduations on the micrometer scale. Every 10 seconds is marked on the left side, and the minutes, on the right. In operation, first the vertical scale is zeroed by turning one of the knobs beneath the window, and then the table is rotated until the horizontal scales are set to zero. (If the nature of the work requires a

Fig. 4. Assembling a group of the optical rotary tables. The power and manual rotation features found in standard tables are retained.

definite starting position, the glass circle can be moved independently without disturbing the table setting.)

To index through a given angle after a zero setting has been completed, the vertical scale is set to show the minutes and seconds above the nearest figure divisible by 5 minutes. For example, 15 degrees 23 minutes 48 seconds would require the scale to be set at 3 minutes 48 seconds, as illustrated in Fig. 2. The table is then rotated beyond 15 degrees 20 minutes, until the graduations on the two horizontal scales appear to coincide.

By a reverse procedure, it is possible to read any angle obtained when checking work: the vertical scale is advanced until the calibrations on the horizontal scales coincide. Then the reading on the vertical scale is added to the angle shown on the horizontal scales.

If the nearest 10-minute calibration has passed the reference pointer, the vertical scale readings will naturally increase until at mid-position a full 5 minutes are shown. Beyond the mid-position, readings become smaller, and from this point until the next 10-minute graduation comes in line, 5 minutes must be added to the angle shown on the vertical scale.

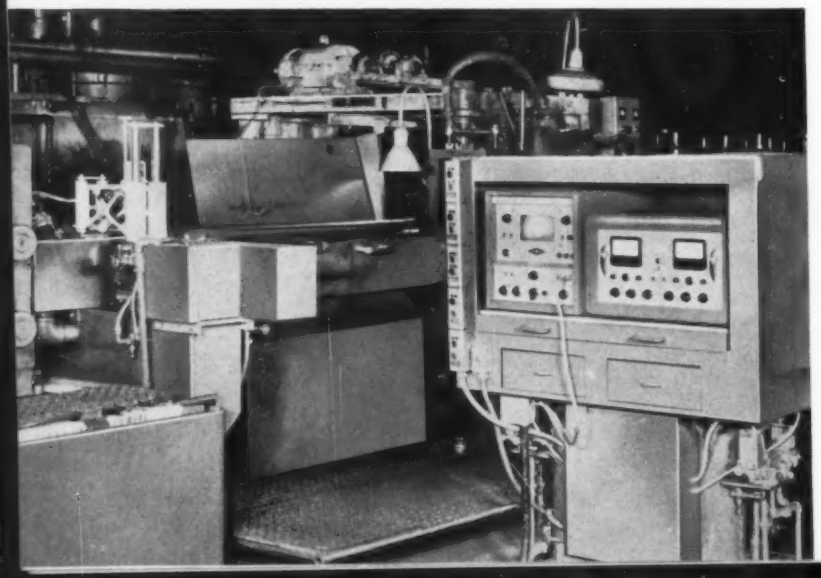
The optical assembly in the table is basically the same one the Gurley company installs in guidance systems and tracking systems. Fig. 4 shows a group of the Pratt & Whitney optical rotary tables at assembly. Like the standard tables, they have integral power and manual rotation in both directions.

Immersed Ultrasonic Inspection of Continuous Welds

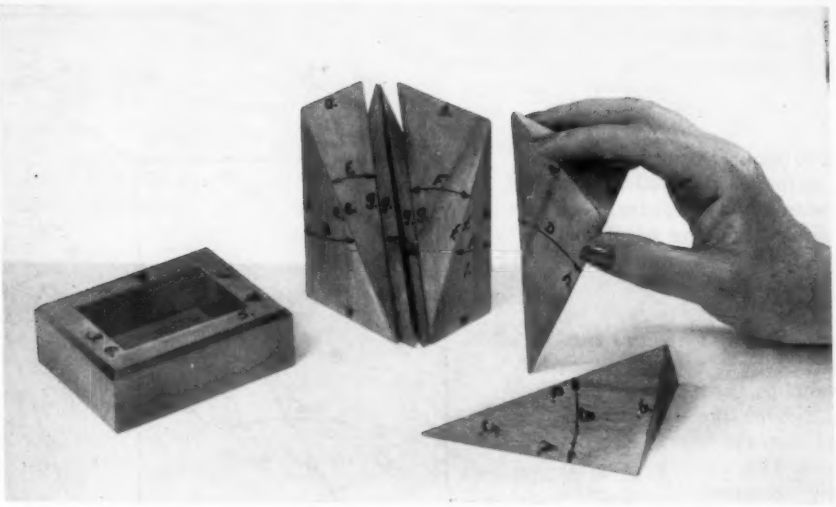
Ultrasonic sound waves are now being projected through water to probe for invisible flaws in continuous welds. Immersed ultrasonic inspection is being used as a quality-control measure in the commercial production of resistance-welded, carbon-steel tubing by the Tubular Products Division of the Babcock & Wilcox Co., Beaver Falls, Pa.

In ultrasonic flaw detection, high-frequency sound waves are beamed into the metal under test, and are echoed back by any defect in the material. The defect is revealed as a pip on the screen of an oscilloscope. Skilled operators can locate the defect precisely by referring to the point at which the waves entered the metal. Air, however, is a poor conductor of sound. For this reason, best results are obtained by directing the ultrasonic sound waves into the metal either by physical contact with the transducer, or through a coupling medium such as water. The latter technique was chosen because of its adaptability to tube-fabrication methods.

One of the most important advantages of the system is a continuous reading of tube-weld quality seconds after the weld is made. When a flaw exceeding a previously determined limit is detected, a warning light goes on, a horn blows at the mill inspector's station, and a spray gun automatically marks the affected tube portion for investigation. Nevertheless, the new equipment is not being used for final acceptance or rejection of the tubing, since immersed ultrasonic testing has not been developed to the point where it can accurately indicate the size of a defect. It is being used, instead, as an additional inspection tool to check the weld at production speeds.



Immersed ultrasonic testing equipment is being used to achieve 100 per cent inspection of the joint area of resistance-welded, carbon-steel tubing. Weld area is tested as the tubing passes through a water tank (left) prior to entering a sizing machine.



Three-Dimensional Model Simplifies Compound-Angle Setups

OTTO SKILD
Trollhättan, Sweden

COMPOUND ANGLES are often encountered when positioning work-pieces for machining and the proper setup is sometimes not readily apparent from the working drawings. A wooden block, sectioned in the manner here illustrated, can be a visual aid to the mechanic in solving the trigonometric problems involved.

Diagonal line g, in passing through the rectangular parallelepiped seen isometrically in Fig. 1, is at a compound angle with each face. The lines d, e, and f represent the projections of line g on these faces. Since the lines on opposite faces are at equal angles with corresponding sides, they are identified by the same letter.

In effect, the line g can represent any line at a compound angle with the three principal projection planes in an engineering drawing. And the lines d, e, and f may be considered the three standard views of line g. The angles at which these projected lines meet the principal reference planes are identified as A, B, and C. Angle D is the angle between line g and an intersecting vertical line. In addition, projected lines e and f are respectively at angles E and F with the line g.

If a block of wood in the form of the rectangular parallelepiped shown in Fig. 1 is cut along the three planes determined by the line g and each of the projected lines d, e, and f, then the resulting six pieces (Fig. 2) can be used to visualize and determine the trigonometric relationships of compound angles. The heading illustration shows a wooden block that has been sectioned for this purpose. In the following problems, which illustrate the use of the sectioned blocks, it should be kept in mind that any block edge g represents any line at a compound angle and block edges d, e, and f represent the orthographic projections of that line.

Example 1: Find C and D when A and B are given.

Use block pieces numbered 4 and 5, or 2 and 3 (Fig. 2). Edge h is common to two right triangles.

Let $h = 1$; then $a = \tan A$ and $b = \tan B$.

Solving for C,

$$\frac{a}{b} = \frac{\tan A}{\tan B} = \tan C$$

Solving for D,

$$\frac{a}{\sin C} = \frac{\tan A}{\sin C} = \frac{a}{d} = d = \tan D$$

also,

$$\frac{b}{\cos C} = \frac{\tan B}{\cos C} = \frac{b}{d} = d = \tan D$$

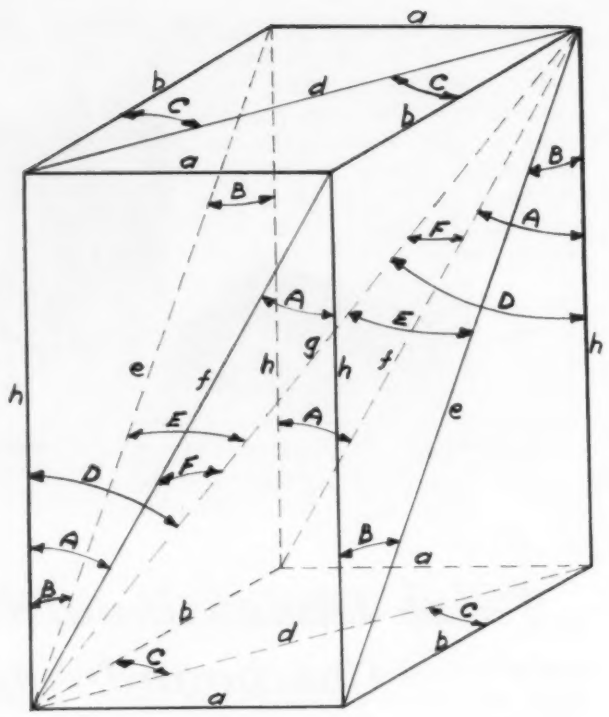


Fig. 1. (Right) Isometric view of a rectangular parallelepiped showing how the wooden block is divided and the edges and angles are identified.

Fig. 2. (Below) Three saw cuts, made at right angles to each parallel pair of faces and passing through the diagonal (g), subdivide the block into six pieces. The block is progressively disassembled to show shape of each piece.

This calculation can be of use when the center line of a hole is shown in two principal views of an orthographic projection and the angles represented by angles A and B on the blocks are given. In order to drill or bore this hole, the workpiece is first secured on a tilting rotary table so that the reference plane is aligned with the tilting axis. Then, after rotating the part through angle C and tilting the table at angle D, the hole can be machined vertically. The use of the blocks as a visual aid in this problem is illustrated in Fig. 3.

Similarly, when other angles and projections are given, the equations in the following problems are used. Trigonometric functions other than the sine, cosine, and tangent have been avoided for simplicity.

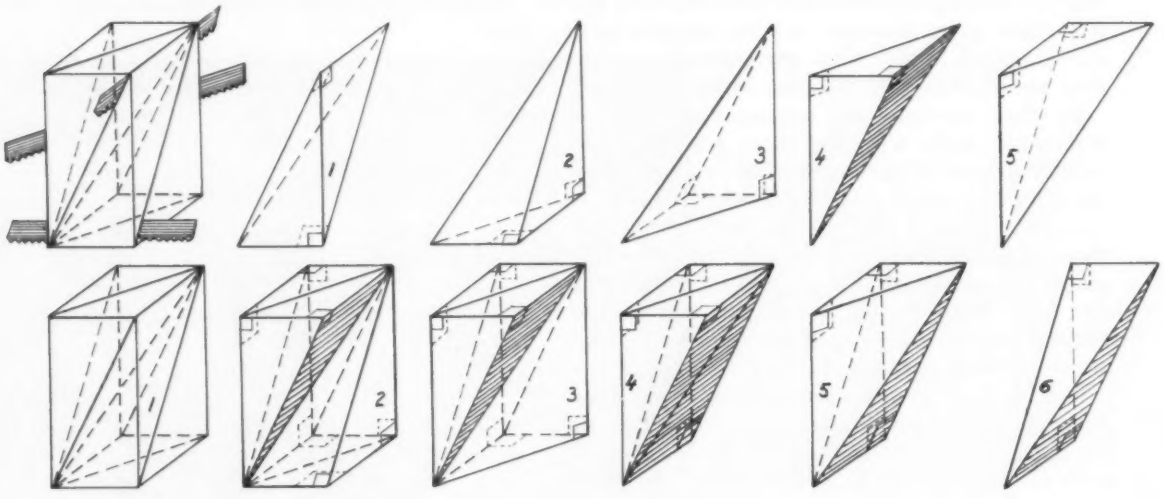
Example 2: Find D when A and C are given.

Use block pieces numbered 4 and 5, or 2 and 3. Edge a is common to two right triangles.

Let $a = 1$; then

$$d = \frac{a}{\sin C} = \frac{1}{\sin C} \text{ and}$$

$$h = \frac{a}{\tan A} = \frac{1}{\tan A}$$



Solving for D,

$$\tan D = \frac{d}{h} = \frac{\frac{1}{\sin C}}{\frac{1}{\tan A}} = \frac{\tan A}{\sin C}$$

Example 3: Find D when B and C are given. Use block pieces numbered 4 and 5, or 2 and 3. Let $b = 1$; then

$$d = \frac{b}{\cos C} = \frac{1}{\cos C} \text{ and}$$

$$h = \frac{b}{\tan B} = \frac{1}{\tan B}$$

Solving for D,

$$\tan D = \frac{d}{h} = \frac{\frac{1}{\cos C}}{\frac{1}{\tan B}} = \frac{\tan B}{\cos C}$$

Example 4: Find E when A and B are given. Use block piece numbered 1 or 6. Edge h is common to two right triangles.

Let $h = 1$; then $a = \tan A$ and

$$e = \frac{h}{\cos B} = \frac{1}{\cos B}$$

Solving for E,

$$\tan E = \frac{a}{e} = \frac{\tan A}{\frac{1}{\cos B}} = \tan A \times \cos B$$

Example 5: Find E when A and F are given. Use block piece 1 or 6. Edge f is common to two right triangles.

Let $f = 1$; then $a = \sin A$ and

$$g = \frac{f}{\cos F} = \frac{1}{\cos F}$$

Solving for E,

$$\sin E = \frac{a}{g} = \frac{\sin A}{\frac{1}{\cos F}} = \sin A \times \cos F$$

Example 6: Find E when B and F are given. Use block piece numbered 1 or 6. Edge b is common to two right triangles.

Let $b = 1$; then

$$e = \frac{b}{\sin B} = \frac{1}{\sin B} \text{ and}$$

$$g = \frac{b}{\sin F} = \frac{1}{\sin F}$$

Solving for E,

$$\cos E = \frac{e}{g} = \frac{\frac{1}{\sin B}}{\frac{1}{\sin F}} = \frac{\sin F}{\sin B}$$

Example 7: Find A when B and F are given. Use block piece numbered 1 or 6. Edge b is common to two right triangles.

Let $b = 1$; then

$$h = \frac{b}{\tan B} = \frac{1}{\tan B} \text{ and}$$

$$f = \frac{b}{\tan F} = \frac{1}{\tan F}$$

Solving for A,

$$\cos A = \frac{h}{f} = \frac{\frac{1}{\tan B}}{\frac{1}{\tan F}} = \frac{\tan F}{\tan B}$$

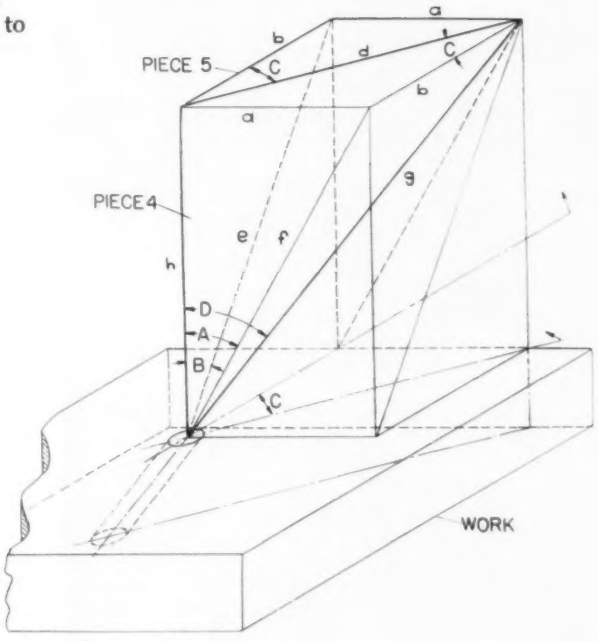


Fig. 3. Here, block pieces numbered 4 and 5 are used to visually indicate how a work-piece must be revolved and tilted in order to position the hole vertically for machining.

Example 8: Find B when A and E are given.

Use block piece numbered 1 or 6. Edge a is common to two right triangles.

Let $a = 1$; then

$$h = \frac{a}{\tan A} = \frac{1}{\tan A} \text{ and}$$

$$e = \frac{a}{\tan E} = \frac{1}{\tan E}$$

Solving for B,

$$\cos B = \frac{h}{e} = \frac{\frac{1}{\tan A}}{\frac{1}{\tan E}} = \frac{\tan E}{\tan A}$$

Example 9: Find F when A and E are given.

Use block piece numbered 1 or 6. Edge a is common to two right triangles.

Let $a = 1$; then

$$f = \frac{a}{\sin A} = \frac{1}{\sin A} \text{ and}$$

$$g = \frac{a}{\sin E} = \frac{1}{\sin E}$$

Solving for F,

$$\cos F = \frac{f}{g} = \frac{\frac{1}{\sin A}}{\frac{1}{\sin E}} = \frac{\sin E}{\sin A}$$

In addition to their use as an aid to machinists in setting up work-pieces on such equipment as tilting rotary tables and magnetic sine chucks for machining purposes, these blocks have been found helpful in the drafting-room. Technical schools can also make good use of this three-dimensional model of a line at a compound angle with the principal planes of projection.

Device Measures Effectiveness of Quenching Media

A magnetic "Quenchometer" promises to be of considerable value in handling a problem that has plagued the steel industry and steel fabricators for years. The General Motors Process Development Section, Detroit, Mich., which is its creator, says the device will determine the cooling or quenching effectiveness of oils, water, brines, or other liquids employed in the heat-treatment of steel.

The steel ball, heated to 1600 degrees F., is dropped into the Quenchometer. Effectiveness of quenching medium is measured by time it takes for ball to regain its magnetism.

Quenching actually is the removal or extraction of heat from metal, and the rate of quenching or cooling affects the steel's ultimate strength. The Quenchometer works in the following manner.

Any magnetic material heated beyond a certain temperature, or Curie point, loses its magnetism. But it regains this when cooled below the Curie point. As an example, a 1-inch ball of high-purity nickel—which is used in the Quenchometer test because it does not scale or crack from repeated heating and cooling—has a 670-degree F. Curie point. Prior to a test with a quenching fluid, it is heated to 1600 degrees F., where it becomes essentially nonmagnetic.

It is dropped into a little cage suspended in a cup of the quenching medium under test. When the ball cools to the point where it regains its magnetism, it is attracted toward a magnet adjacent to the container, carrying the cage in which it is suspended with it.

A timing circuit gives an accurate measurement from the instant the ball drops into the cage until it is attracted to the magnet. This interval is a measure of the cooling ability of the quenching fluid. Time intervals vary according to different fluids such as fast oils, medium oils, brines, water, etc.

Extruded and Die-Cast Aluminum Parts Effect Economies at Chrysler

HERBERT CHASE

AT THE INDIANAPOLIS PLANT of the Chrysler Corporation, large savings have been achieved by a change-over to aluminum for two servo parts of the PowerFlite automatic transmission. Formerly turned from steel bar stock, these components are now produced in unfinished form by vendors as impact extrusions and die-castings. Though sizes remain substantially the same as for the steel part, only a minimum of machining is required at the company's shop.

As a result, fewer machines are taking only light cuts at high speeds. Moreover, the volume and weight of chips are greatly decreased. These components perform fully as well as the steel, and consequently there is no sacrifice in the quality of the parts.

Of the two parts, the one called a "transmission reverse servo piston sleeve," Fig. 1, is the smaller and is made by impact extrusion. In this process a slug of wrought aluminum is placed in a die and struck a single blow by a punch. The blow causes part of the metal to flow through an annular opening between the punch and the die, thus forming the hollow portion. The remainder is forced to conform to the shape of the die on the outside surface and to the end of the punch on the inside surface.

As close dimensions are held, practically the whole outside surface remains as extruded. After the open end has been cut off in a LeBlond lathe, most of the machining is done, two pieces at a time, in the Ex-Cell-O boring machine shown in Fig. 2. Here the bore is finished to between 1.2165 and 1.2175 inches in diameter, and to a depth of 1 37/64 inches. A 30 micro-inch or better finish is maintained. An inside chamfer is also formed and the burr is removed from the outside edge.

Formerly, production of the basic part was originated in a six-spindle screw machine which turned and formed the outside diameter before cutting off. The parts then went to a chucking machine for drilling, rough-boring, and the machining of steps at the bottom of the hole. A boring machine was used to finish the bore. For both versions of this part, the drilling of small cross-holes is done on a Kingsbury machine. It is not necessary to finish the closed end of the extrusion, which, in completed form, costs considerably less than the original part machined from steel.

Production of the PowerFlite automatic transmission reverse servo piston, Fig. 3, at the necessary rate from steel bar stock, required nine machines (three automatics, three chucking machines, and three precision boring machines);

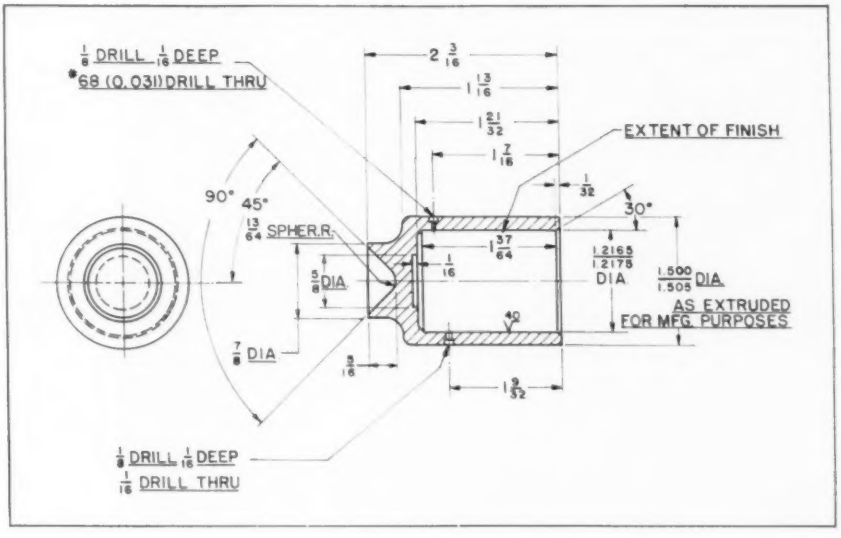


Fig. 1. Nearly all of the external surface of this aluminum piston sleeve remains as extruded. The bore is machined to close limits after open end has been faced off.

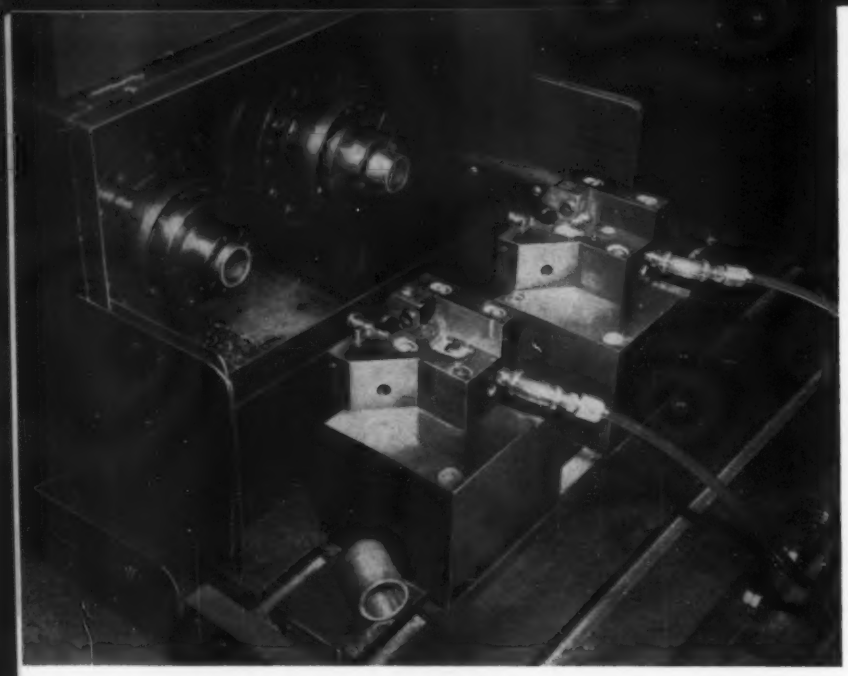


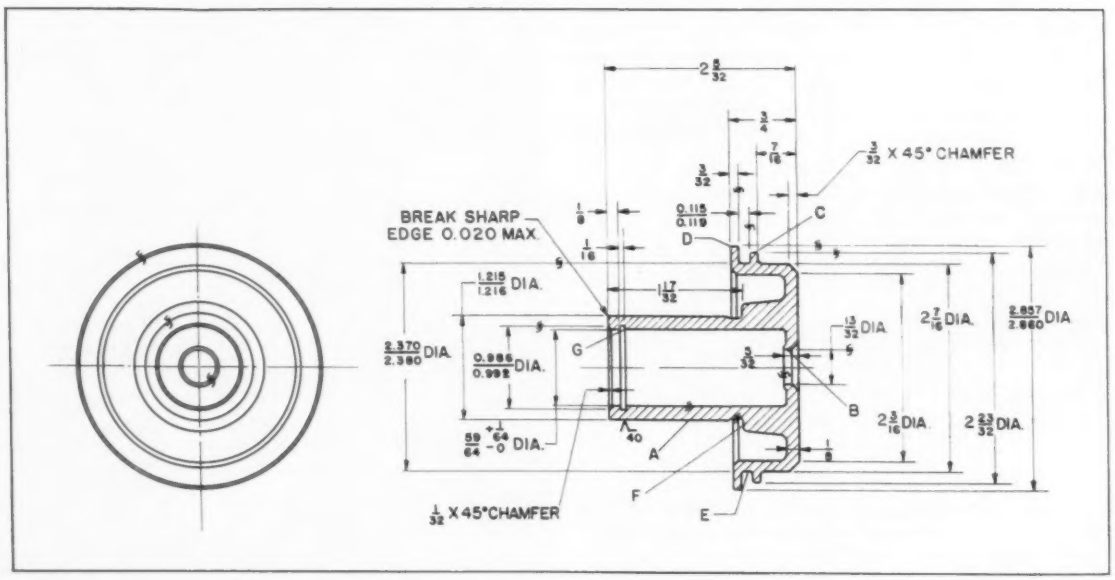
Fig. 2. Setup in which extruded sleeve is precision bored. The part as it comes from the machine appears in the foreground.

each with an operator. Now, with the piece die-cast from aluminum alloy, the whole job is finished in three Ex-Cell-O boring machines, one having two spindles and the other two having four spindles each, two at each end. Three operators are required, one for each of the boring machines.

In the two-spindle machine, the two castings are air chucked on the surface having the largest diameter and are bored. Next these two castings go to the left end of the two four-spindle machines and are similarly chucked on the cylindrical extension *A* as shown in Fig. 4. There the small hole *B* at the flanged end is bored and the surfaces *C* and *D* are turned. In addition, the outer ring groove *E* is formed and the end is spot-faced for location.

When these operations are finished, the parts are chucked at the opposite end of the same two machines, as illustrated in Fig. 5. After being located by the small hole and the finished face of the flange, the cylindrical extension *A* is turned within 0.0005-inch limits, with a 20-micro-inch or better finish. The step *F* is then faced, as are

Fig. 3. This transmission reverse servo piston is now made as an aluminum die-casting. Boring, turning, facing, and grooving cuts are made in three chuckings.



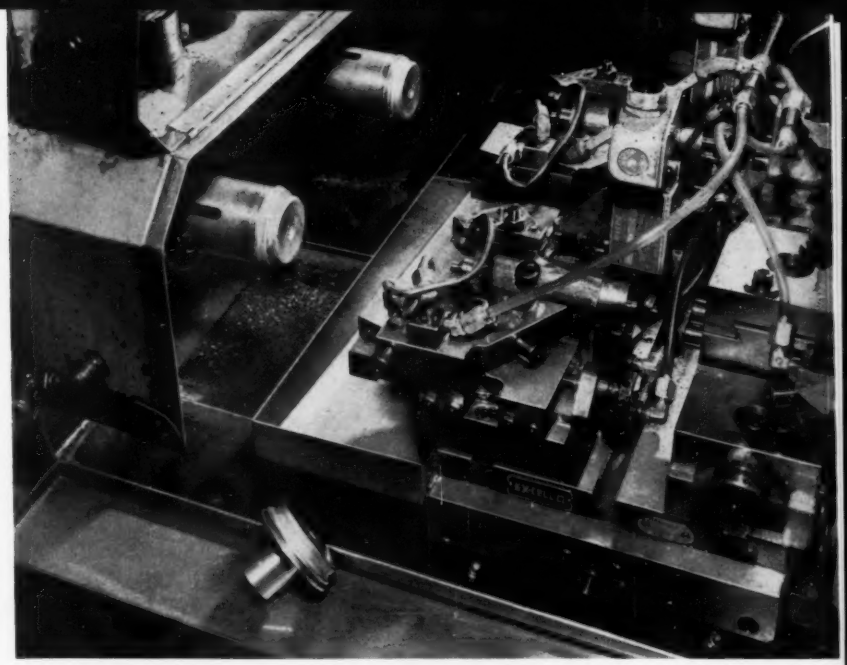


Fig. 4. Boring the small hole, facing the end, and forming the groove of the die-cast piston are accomplished in these two chucking positions.

the recessed face and the end of the extension. A ring groove *G* is also cut. Twenty-six tools are required in each double-end machine, but 700 pieces are finished in each machine during an eight-hour shift.

By using the die-casting, which is received close to finish size, and machining it as described, a large saving per piece is realized. In addition to these machining economies, there is a marked reduction in chip waste as the formerly made steel part had to be turned from bar stock.

Highly Permeable Wear-Resistant Alloy

Alfenol, a soft magnetic material which couples high permeability with high wear resistance, is being offered to American industry in commercial quantities by the Hamilton Watch Co.'s Metals Processing Section, Lancaster, Pa. This alloy (16 per cent aluminum and 84 per cent iron) contains no strategic elements normally associated with high-permeability materials. It is now available in strip form as thin as 0.025 inch.

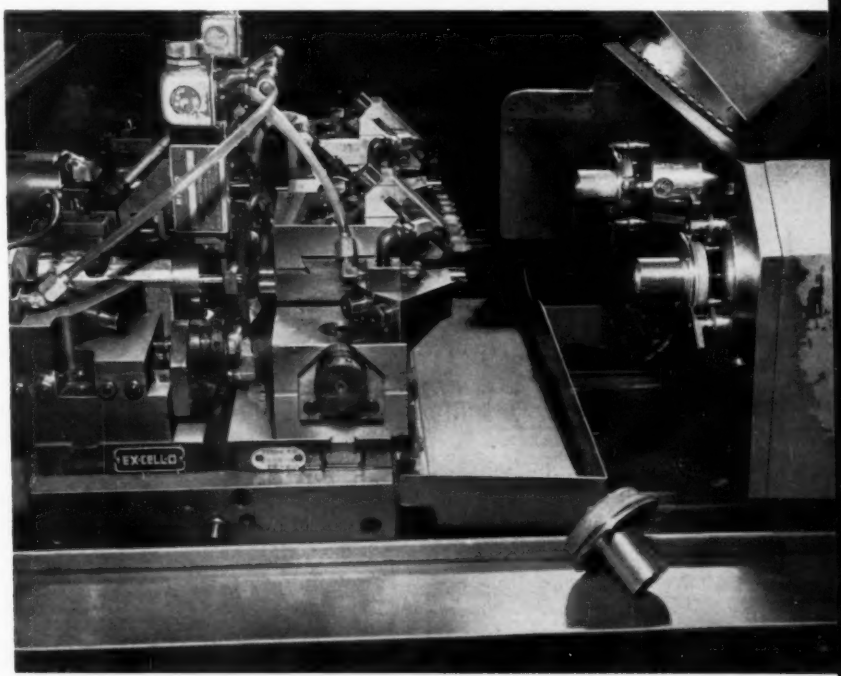


Fig. 5. Two die-cast aluminum pistons are here shown in the final machining position of the double-end machine. Precision turning of the extension is done in this position.

Four-Spindle Boring Machine Controlled by Punched Tape

TO FILL A NEED for greater automation in the aircraft industry, a horizontal precision boring machine has been developed specifically for use with two-motion numerical positioning control. Design of the unique four-spindle machine was directed at the special manufacturing requirements for components of J-79 and CJ-805 jet engines.

The boring machine, which has been built by the Barnes Drill Co., Rockford, Ill., is intended to work on the periphery of cylindrical parts ranging up to 50 inches in diameter and 40 inches in length. A 55-inch diameter rotary table, powered by a 1 1/2-hp, 280-rpm motor, will travel through a full 360 degrees at a speed of approximately 5/6 rpm. It will index from a given reference point to a position tolerance of 0.005 inch at a 50-inch diameter—repeatable within 0.001 inch. The table is equipped with a lifting mechanism for rotating and a clamping arrangement for locking.

Machining is done by a four-spindle heavy-duty boring head mounted on a compound slide. Each spindle is individually controlled for three different feed-out ratios. Driven by a 1-hp motor, the boring head can be moved vertically at a speed of 60 inches per minute through a travel range of 40 inches. As with the rotary table, the head will locate to a position tolerance of 0.005 inch—repeatable within 0.001 inch.

Numerical positioning control equipment was designed and built by the Specialty Control Department of the General Electric Co., Waynesboro, Va. Punched paper tape directs rotary motion of the work-table and vertical motion of the boring head when positioning for such operations as spot-facing, boring, reaming, tapping, and chamfering. In addition, the tape selects operating conditions of the machine, such as the spindle to be used, the speed of that spindle, its feed rate and depth of cut. Commands to the machine such as "position only" or "drill," "dwell" or "no-dwell," as well as instructions to the operator at any point in the program, are also controlled by the tape. As many as four operations can be performed on any specific hole. A primary advantage of this control system is its ability to select hole size, depth, and exact position in approximately two seconds.

Information for vertical positioning is punched in the tape in increments of 0.001 inch, which is the smallest increment that can be recorded for

this movement. Rotary-indexing information is punched in terms of degrees and decimal parts of a degree. The smallest unit that can be recorded is 0.002 degree. This unit, when converted to a linear dimension, is the equivalent of 0.001 inch on a 27 1/2-inch radius.

All positioning is measured from a common, or zero, reference point to eliminate the possibility of accumulative errors as the operation progresses. The necessary information is taken directly from the engineering drawing in coded decimal form. It is then punched in standard eight-channel paper tape, using any commercial controls typewriter. The tape reader used with the control equipment is a standard commercial unit and is equipped with a magazine for storing 100 feet of endless tape.

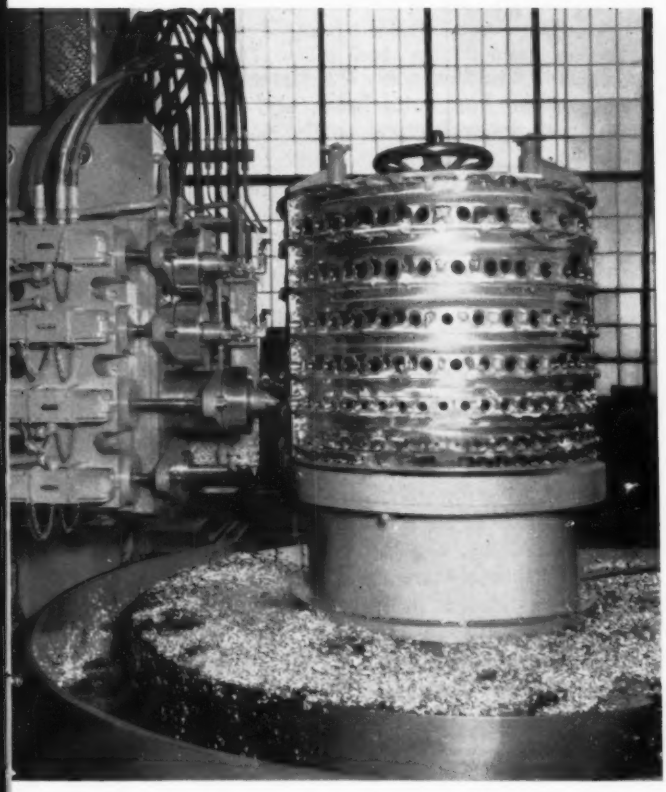
An automatic lubrication system services all required points of the machine. Signals are provided to warn of low oil level or broken lubricating lines. Spindles in the boring head are lubricated by an oil mist.

Boron-Bearing Cast Carbon Steel for Tractor Sprockets

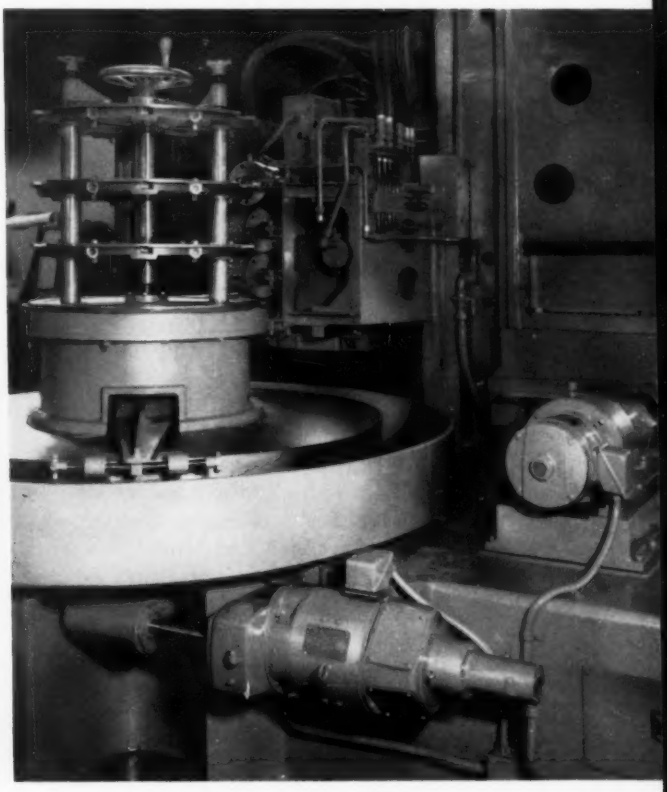
Boron is being used to increase the life of sprockets on Caterpillar crawler tractors. Representing the first commercially successful attempt to produce boron-bearing cast carbon steel by the acid open-hearth process, the Boralloy sprocket was developed as a co-operative research project between Caterpillar Tractor Co., Peoria, Ill., and Harrison Steel Castings Co., Attica, Ind.

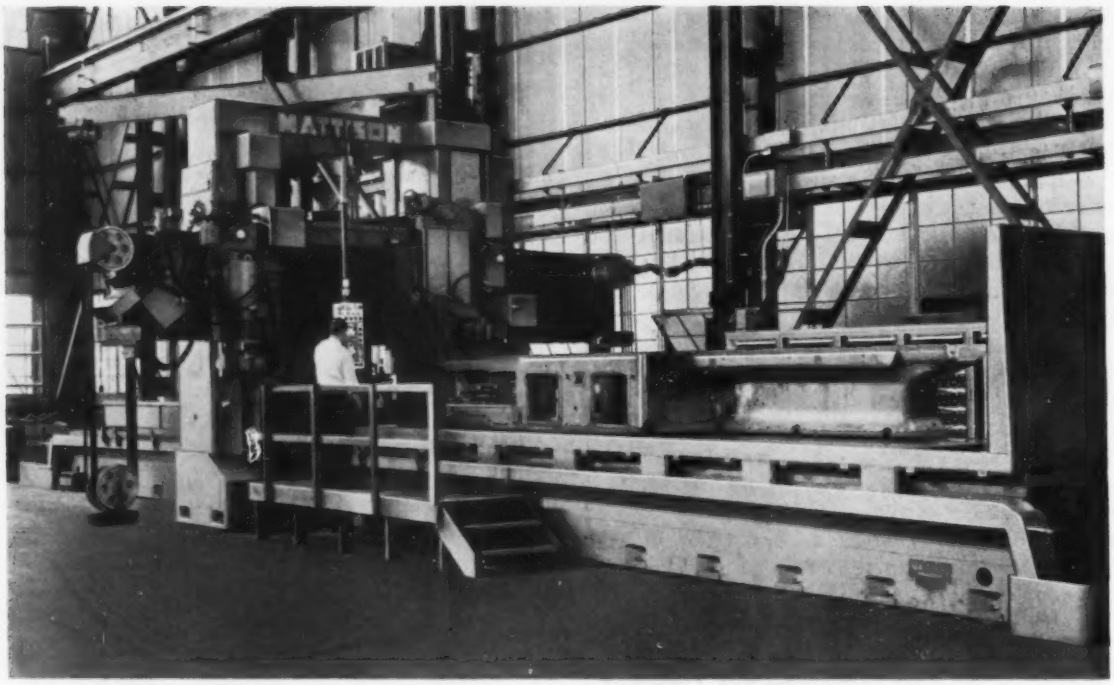
Tests made from samples of the first boron steel heat indicated a hardness depth 2 1/2 times greater than that of straight carbon steel of the same chemistry. The amount of boron compounds added to each heat is less than 0.005 per cent of the steel's total composition. Patterns of the sprockets were changed in order to provide enough metal section to effectively utilize the depth of hardness developed in the boron steel during conventional heat-treatment.

A total of 248 holes are finish-bored, spot-faced, and back-counterbored in this jet-engine compressor casing during an uninterrupted machining sequence. The holes are of three different diameters. An alignment telescope is used to position the casing on the rotary table (heading illustration).



Four-spindle, numerically controlled boring machine as viewed from the right, rear. Work-holding fixture on the rotary table is seen before mounting a compressor casing. Zeroing of the fixture on the rotary table is accomplished by means of the two adjusting screws in front of the fixture base.





Dual-Spindle Surface Grinder Cuts Machining Time

A VARIETY OF SURFACES on large work can be handled in a single setup on a new Plano surface grinder developed by the Mattison Machine Works, Rockford, Ill. Both a vertical and a horizontal work-spindle are carried on an overhead cross-rail (heading illustration), thereby assuring precise relative alignment of all finished surfaces.

Clearance between the upright columns provides a maximum work width of 80 inches, although the tabletop measures 60 inches wide by 24 feet long. A further indication of the capacity of the machine is a 60-inch clearance between the tabletop and the grinding wheels with the cross-rail in its uppermost position.

Horizontal-spindle motors can be had in ratings ranging from 30 to 75 hp and will accept cylinder wheels up to 24 inches in diameter with a 6-inch face width. A power-operated wheel dresser is positioned on the horizontal head. It can be used to dress the abrasive wheel to an angle of 45 degrees either side of center.

Ratings of 30 to 50 hp are available for the vertical spindle. Maximum for this spindle would be a 20-inch diameter segmental wheel. The machine illustrated, built for the Kearney & Trecker Corporation, is equipped with 30-hp motors on both spindles, a 22-inch diameter cylinder wheel on the horizontal head, and an 18-inch diameter segmental wheel on the vertical head. The vertical head can be swiveled at an angle up to 50 degrees either side of center to permit grinding of contours such as V-ways, dovetails, and shoulders.

Both heads are controlled by the operator from a single pendent. An interlock system prevents damage to the machine and the work should a wrong control button be depressed. A load meter is located above each work-head. The meter is graduated up to 150 per cent of full spindle load.

Among the machine controls provided at the pendent are cross-travel of each spindle head (including selection of reversal points), table speed, feed rate of each head, raising and lowering of the rail, inching the table forward or reverse, and stop and start of table movement. Pilot lights on the pendent indicate the operative controls. Limit points of head reciprocation are controlled electronically—no dogs are used.

Cross-feed can be controlled either hydraulically or mechanically. Jump-feed is controlled at the pendent and can be varied from 1/2 to 4 inches. Mechanical micrometer cross-feed in in-

crements of 0.0002, 0.001, or 0.002 inch can also be set at the pendent. Similarly, mechanical micrometer vertical feed in increments of 0.0002, 0.001, or 0.002 inch can be set at the pendent control and actuated either by push-button or by reversal of either the cross-slide or the table. Total travel of the heads (one at a time) along the rail is 10 feet. Feed rate of the cross-slides ranges from 5 to 30 fpm (feet per minute).

All machine movements are hydraulically powered with the exception of the cross-rail. This is raised and lowered by a 10-hp motor-driven screw. In locking the cross-rail, automatic spring clamps on the main upright column are actuated first, then those on the outboard column. The rail unlocks hydraulically, being controlled from the pendent. Fail-safe clamping is assured in the event of electric or hydraulic power failure.

A 10-hp constant-flow pump supplies hydraulic pressure for operating the cross-slides and the rail locks. A 40-hp hydraulic system, utilizing a piston type variable-volume pump, serves the work-table only. Two hydraulic rams, each 4 1/2 inches in diameter and 8 feet long, operate the table (one ram driving in each direction). Feed rate for the table ranges from 5 to 100 fpm.

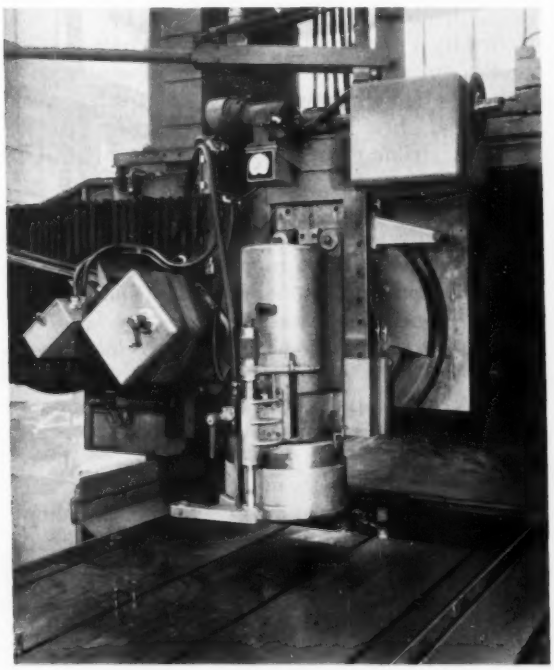
All principal parts of the grinder are lubricated automatically. The cross-rail and cross-slides have their own pressurized system and are lubricated every three minutes. A continuous-pressure lubricating system services the horizontal spindle, while the vertical spindle is equipped with grease-sealed bearings. The work-table is serviced by a continuous-pressure lubricating system. This is interlocked with the table drive-control so that the table will not move if the lubricating system is not functioning properly.

* * *

"Project Split Inch"

A nationwide team of government and industry scientists is getting ready to give the familiar inch a thin time. Objective of the project, which is in its second year, is to develop an absolutely accurate set of standard "master" references for measuring the inch as close as one-tenth of one-millionth. Being used in this major scientific project are combinations of finely finished metal blocks, pure light sources, controlled air streams, and precise optics.

Vertical work-spindle is located on the left-hand side of the cross-rail. The spindle can be tilted either left or right to an angle of 50 degrees. Although a 30-hp motor drives the spindle illustrated, up to a 50-hp motor can be used. A load meter on each slide indicates up to 150 per cent of full spindle load.



Horizontal work-spindle is located on the right-hand side of the cross-rail. A 30-hp motor is being used in this instance, but a motor rated at up to 75 hp can be accommodated. The abrasive wheel can be formed to an angle of up to 45 degrees either side of center by an integral wheel dresser.

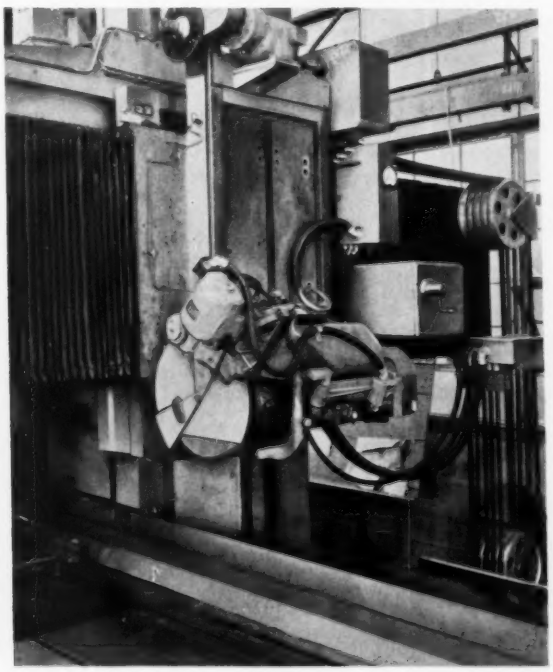


Fig. 1. Close-up view of an aluminum-bronze nozzle for a servo valve at completion of turning, facing, and drilling operations in a jeweler's lathe. The standard watchmaker's drill in the tailstock collet is 0.027 inch in diameter.

Missile Parts Machined in Jeweler's Lathes

Miniature instrumentation is critical to the success of guided missiles. By its very nature, the defense program requires the machining of an ever increasing number of diminutive components to closer and closer tolerances. At the Pacific Division of Bendix Aviation Corporation, North Hollywood, Calif., light and sensitive jeweler's lathes are used for many precision operations on servo equipment in guided missiles.

Servo valves having nozzle holes as small as 0.0045 inch in diameter are an example of the class of work handled on the six Levin jeweler's lathes currently in use at the company. In Fig. 1, the aluminum-bronze nozzle of a servo valve that has just been drilled with a standard watchmaker's drill 0.027 inch in diameter is seen close-up. Depth of the hole and the outside diameter are each 0.187 inch. The part is turned and the cone is faced (Fig. 2) in the same machine. This servo valve can accept 300 commands a second.

As the lathe shown is equipped with a Levin micro-drilling attachment, the drill feed is controlled by a micrometer screw and is independent of the pressure exerted by the operator. The drill may be withdrawn at any time to clear away chips and then be returned to cutting position without striking the bottom of the hole. This helps to prevent drill breakage. Successful production of very small holes with this machine is due not only to use of the micro-drilling attachment, but also to accurate drill collets and provision for precise alignment of the drilling spindle with the headstock spindle.

In general, the jeweler's lathes have been found especially suited for operations on miniature instrument parts that require tolerances and concentricities of less than 0.001 inch. Continuance of the present trend in the size of instrument parts is sure to make the jeweler's lathe a more common sight in many machine shops.

Fig. 2. Operator is facing the cone of the nozzle shown in Fig. 1. Both the headstock and tailstock collets of the jeweler's lathe can be revolved during drilling.

MATERIALS

The properties and new applications of materials used in the mechanical industries

Pre-Plated Metal with Over-All Uniformity when Drawn

A pre-plated metal, known as "specification plate on ChromSteel," makes possible heavy-chromed finishes of uniform quality according to an announcement from the Apollo Metal Works, Dept. MYN, 6650 S. Oak Park Ave., Chicago 38, Ill. It can be stretched without danger of drawing out the luster of the satin finish. Even on highly polished surfaces, deep draws can be made. Deep stretching or drawing does not lessen the resistance to corrosion.

Applications include automotive trim and accessories, general fixtures, home appliances and parts, interior trim, and electrical uses.

Epoxy Resin Die Surface Coating Provides Hard Facing

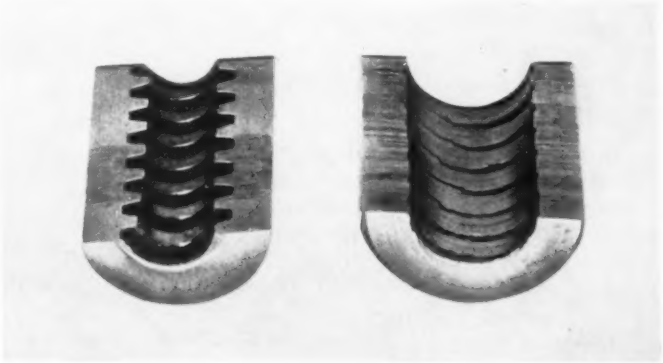
A blue epoxy resin compound developed by the Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N. J., has been formulated for use in hand lamination systems where surface hardness and resistance to abrasion are desired. "Sonite SC-2," as the compound is called, has sufficient thixotropy for application as a heavy brush coat, without sagging on a vertical surface. When used with the company's Sonite LM-1 laminating resin and glass cloth, the SC-2 produces hard-surfaced dies of light weight, high strength, and dimensional stability. It may be used alone as a surface coat for tanks and barrels and as a bonding agent with good adhesion, chemical resistance, and stability.

Aluminum Powder Metallurgy Products for High Temperature Applications

The Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa., has recently announced the commercial availability of aluminum powder metallurgy products. The products, designated by the initials "APM," are made by subjecting powdered metal to heat and pressure.

Three APM alloys are now available: APM Alloys M257, M430, and M470. They are available in the form of extruded shapes, forgings, sheet, foil, drawn and extruded tube, impact extrusions, fasteners, and wire. These products can withstand temperatures up to 900 degrees F. and they can be anodized. Anodizing produces a hard oxide coating which prevents moving parts from sticking. The products can also be electroplated by regular methods and, in addition, have a high resistance to recrystallization and to overheating.

Applications indicate that the products may be used for making honeycomb sandwich structures and hot-air valve housings. In tube form it is being considered for airborne heat exchangers. Fasteners such as rivets, screws, nuts and bolts are also being made from the materials.



The simple feed nuts pictured were used on hospital beds in a test to show the relative wearing qualities of bronze and Oilite self-lubricating bronze. The one on the right failed to function after 2223 cycles of bed raising and lowering. The one on the right made of the Oilite underwent 44,265 cycles without any apparent wear. Oilite self-lubricating bronze is a product of the Amplex Division, Chrysler Corporation, Detroit, Mich.

Addition of Copper to Steel Bars Improves Machinability

The intentional and controlled addition of copper to the La Salle Steel Co.'s "Stressproof" steel bars in order to improve machinability and other physical and mechanical properties has been announced by the La Salle Steel Co., 1420 150th St., Hammond, Ind. The addition of the copper, which is uniformly distributed, provides a ten per cent increase in machinability compared to Stressproof steel bars without copper, which in themselves were already considered free machining. The steel bar is also made more wear resistant and its guaranteed minimum tensile strength is 100,000 psi in sizes through 2 inches and 90,000 psi in sizes through 3 3/8 inches.

Welding Flux for Cast-Iron Welding and Brazing

A welding flux called "Ampco-Braz Flux #2," which is suitable for general brazing, cast-iron welding and cast-iron brazing when used in conjunction with the oxy-acetylene process, has been introduced by Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 46, Wis. The flux possesses the following advantages: it has good wetability, is non-fuming and non-toxic, has ability to depress filler metal bubbling and fuming, has deep penetration, gives protection against excessive oxidation, dissolves and removes oxides formed, provides dense, sound deposits, and is easily removed from deposits.

Barrel Finishing Compound that Combines Burnishability with Neutrality

A neutral, powdered, non-abrasive compound called "Esbec No. 234" has been announced by the Esbec Barrel Finishing Corporation, 18 Beech St., Byram, Conn. Its use eliminates the necessity for a subsequent neutralizing operation. It removes rust, oxide stains, and light heat-treat scale, and produces burnishing results in 15 to 45 minutes with small chips of steel-burnishing media. Only two to three ounces of compound are required per gallon of water.

Heavy-Duty Soluble Cutting Oil Increases Efficiency

An emulsified cutting oil which substantially increases the efficiency of many heavy-duty machining and grinding operations has been announced by Gulf Oil Corporation, Gulf Bldg., Pittsburgh, Pa. "Gulfcut Heavy Duty Soluble Oil," as it is called, combines the cooling ability of water with the lubricity and protection of oil. It does not foam, is highly resistant to oxidation, and will not form gum on ways, slides, or other machine parts. The oil provides a tough, thin film between the cutting tool and work-piece, thereby providing lubrication of the cutting edge, which keeps tools sharp and lengthens their life. In grinding operations, good finishes are produced with minimum wheel loading and breakdown.

The average mixture is 25 parts of water to one part of soluble oil. Applications include heavy hogging cuts, fast fine cuts, boring, and grinding of ferrous and non-ferrous metals and alloys, including tough titanium alloys.

Precision Ground Stainless-Steel Shafting Available from Stock

The availability from existing stock of precision-ground shafting in sizes of 1/32, 1/16, 3/32, 1/8, 5/32, 3/16, 1/4, 5/16, 3/8, and 1/2 inch diameter has been announced by the PIC Design Corporation, 477 Atlantic Ave., East Rockaway, N. Y. The centerless-ground shafting, called "Type A8 Precision Ground Shafting," is finished to 10 micro-inch roughness value or better and has a tolerance of plus 0.0000 inch and minus 0.0002 inch.

Vinyl Paint Which Can Be Sprayed Thickly in One Pass

Coatings of 5 mils per pass (cold) or 8 mils per pass (hot) can be sprayed on ferrous metal surfaces using "Lankote 200-H" according to the J. Landau Co., Carlstadt, N. J. These high-gloss corrosion-resistant fast-drying vinyl coatings are available in eight colors. They have good flow-out and brushability, flexibility, abrasion resistance, and adhere well to ferrous metals.

Gear Lubricant that Minimizes Wear and Noise in Presses

A gear lubricant that arrests gear wear and reduces noise in metalworking press applications has been announced by the Keystone Lubricating Co., 3100 N. 21st St., Philadelphia, Pa. Called "Keystone 122C-5X," it possesses a high film strength, provides lubrication under extreme operating pressures, and exhibits a high resistance to thinning out under heat and pressure. In use it retains essential sealing qualities and thus minimizes leakage.

Coatings for Structural Aluminum Alloys Used at High Temperatures

Ceramic coatings have been applied to the so-called "strong" structural aluminum alloys by Gulton Industries, Inc., 212 Durham Ave.,

Metuchen, N. J. This "Gulton Ceramic Coating Process" coats aluminum alloys so they can withstand prolonged heat at 1300 to 1350 degrees F. without collapsing. The coated alloys can be bent, drilled, and punched without fracture or damage to the coating. The coating may be applied before final heat-treating of the alloys, thus combining heat-treating and firing of the coating into a single operation. This insures optimum strength of the metal and best adherence of the coating.

Material for Filling Metal Honeycombs to Facilitate Machining

A material for filling stainless-steel and aluminum honeycomb preparatory to contour machining has been announced by Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif. Epofil B-1 is a hot-melt waxlike substance which is quite easy to remove from the metal honeycomb after the machining operation.

Reverse-Current Cleaner for Cleaning of Steel before Plating

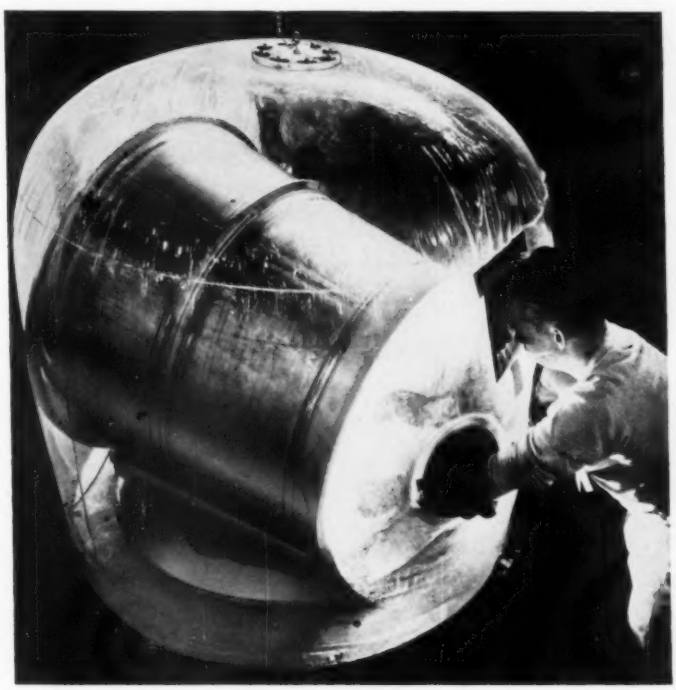
A reverse-current cleaner, called "Oakite Composition No. 90," for electrocleaning of steel before plating has been made available by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. Advantages claimed for this detergent cleaner are high conductivity, good smut removal, controlled foaming, and long life in solution. Solutions of the material are said to have a high tolerance for chromic acid and also protect against hydrogen embrittlement. Solutions have effective wetting and emulsifying properties for thorough removal of soils and smuts.

High-Strength Aluminum Alloy Developed for Welded Structures

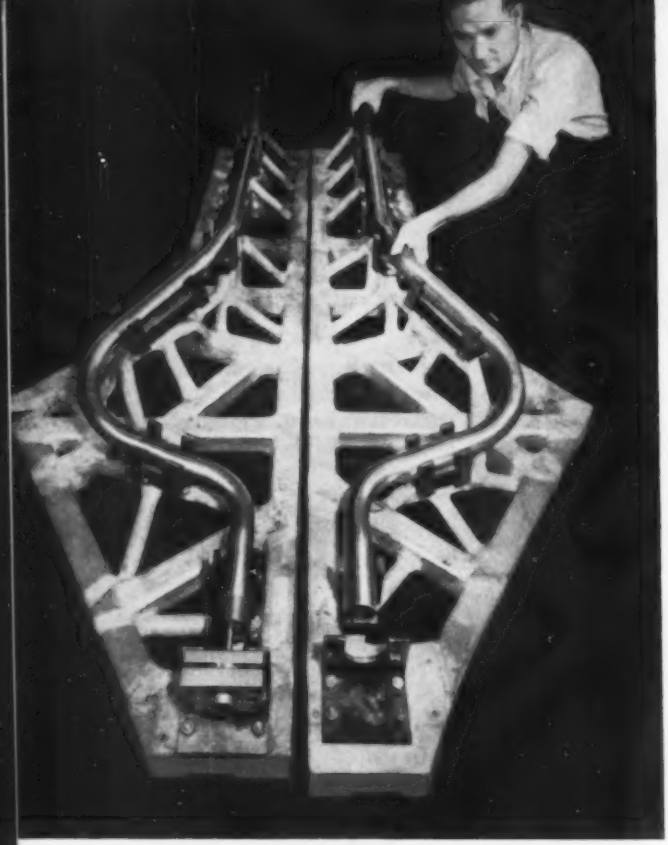
A high-strength alloy developed especially for welded aluminum structures which must operate at moderately elevated temperatures was announced by the Aluminum Company of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa. Designated "X5454," this alloy should find extensive application in the process industries where chemicals are handled at elevated temperatures.

When used continuously or intermittently in temperature ranges of from 150 to 300 degrees F., this alloy displays high resistance to corrosion and stress corrosion in all temper specifications. Welding characteristics of the alloy are good. Best results are obtained by using the inert-gas shielded consumable arc method of welding. The inert-gas tungsten-arc method can be used on thicknesses up to 1/2 inch.

The tensile strength of arc-welded joints is equal to the tensile strength of the alloy in the annealed temper. The tensile strength of sheet and plate in extruded shapes and tubes ranges from 36,000 to 49,000 psi and the per cent elongation in two inches ranges from 8 to 22, both depending upon the temper.



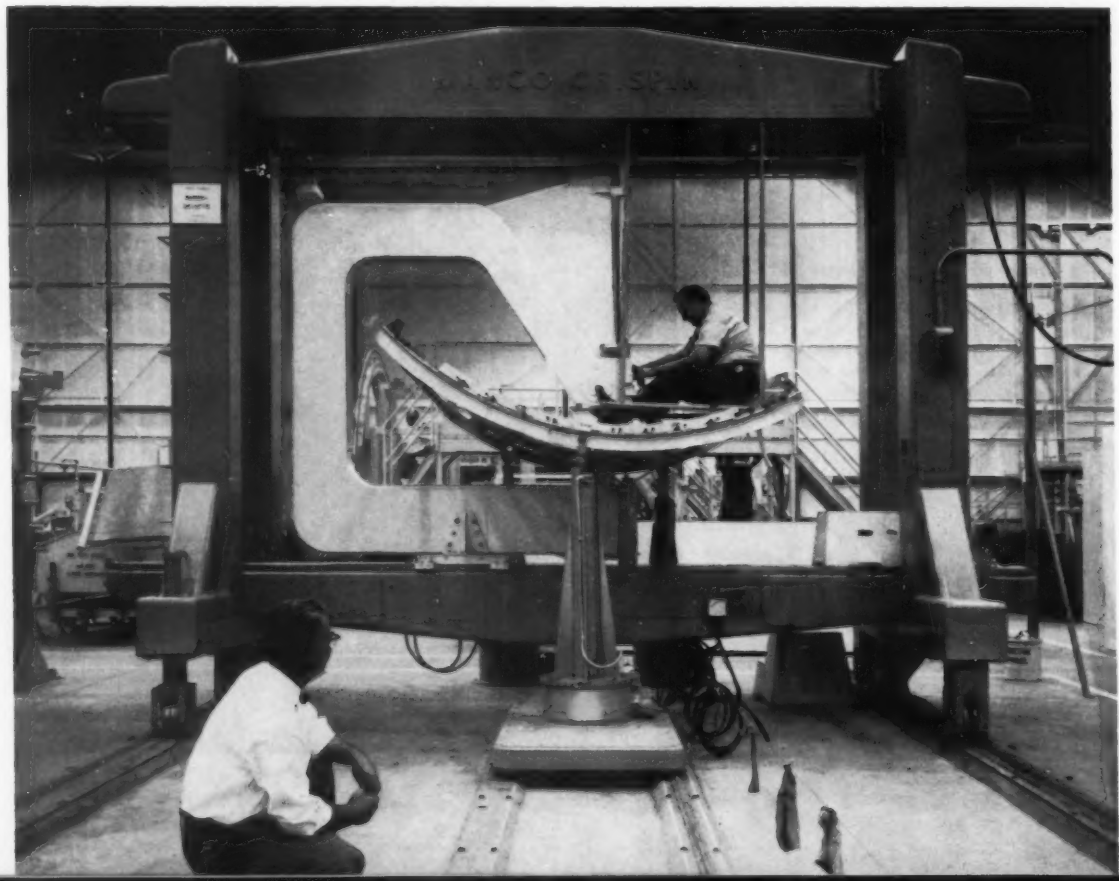
Argon-inflated welding tents like this one are fabricated by the Pioneer Valley Plastics Co., Chicopee, Mass., from Krene (registered trademark of Union Carbide Corporation) cast vinyl plastic. A tent is being used in this case for the welding of titanium in an inert-gas atmosphere. The pressure (slightly higher than atmospheric) of the argon gas keeps the tent inflated. Sleeves with attached gloves are built right into the tent. A shield which filters out the harmful glare of the electrode allows the welder to view his work.

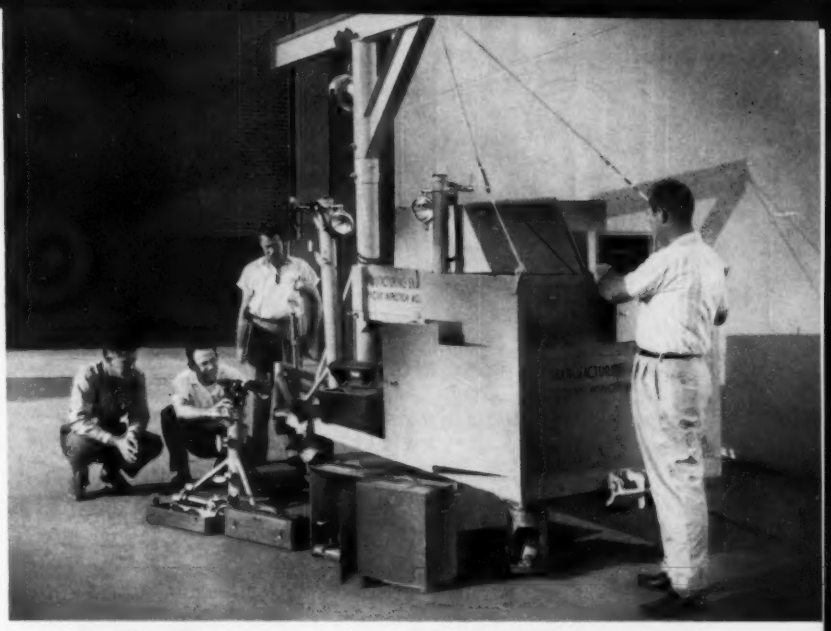


Camera highlights of some interesting operations performed in various metalworking plants

PLASTIC BEND CHECKER—Inspecting automobile tail pipes at Arvin Industries, Inc., Columbus, Ind. Checking fixtures, 6 to 8 feet long, gage three to six bends in the pipes. Fixtures are constructed of a Bakelite epoxy resin. Arvin also uses this tooling compound in forming dies for tubular aluminum outdoor furniture.

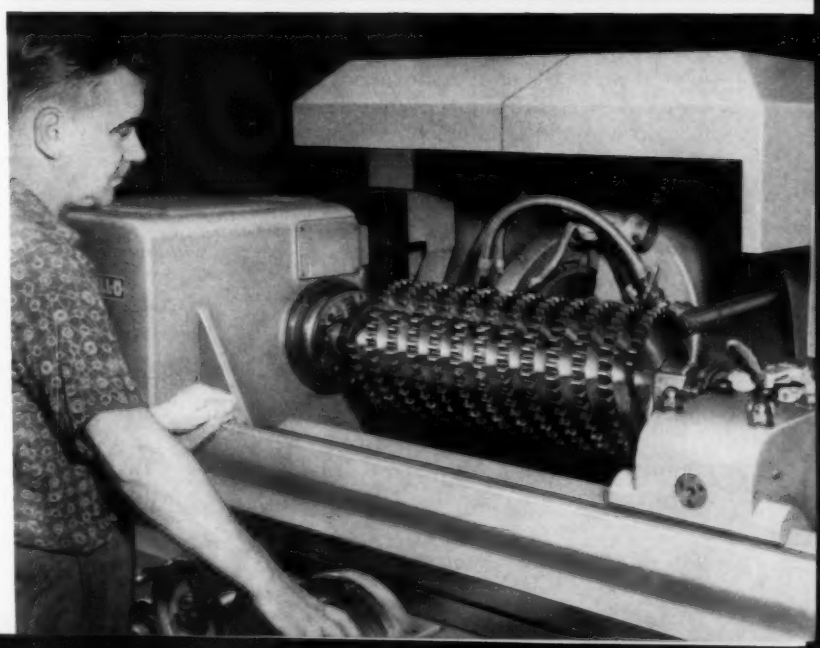
GANTRY RIVETER—A Manco-Crispin machine rivets a DC-8 fuselage panel at the Douglas Aircraft Co.'s Long Beach, Calif., Division. Gantry moves over the panel, which is supported on a three-point sensing unit that keeps the riveting locations at 90 degrees to the anvil. In automatic cycle, the panel is squeezed upward, then the rivet is upset and excess metal shaved off.



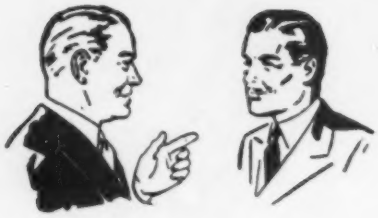


TRAVELING INSPECTORS—At Chance Vought Aircraft, Dallas, Tex., 144 jigs in various areas of the plant are inspected by a full-time traveling team. The mobile unit stores and transports delicate optical instruments and other inspection aids. The frame and hoist load and unload master parts from the jigs.

EYEING THE HEAT—At Republic Aviation Corporation, Farmingdale, N. Y., a titanium sheet is brought up to forging temperature right in the hammer by means of resistance heat. A Servotherm infra-red pyrometer mounted on a tripod measures the sheet's heat.



WORM HAS TEETH—Grinding the thread form of a large worm at the Ex-Cell-O Corporation, Detroit, Mich. The worm, having an outside diameter of 10 inches, is used in a Johnson drive for a large machine tool table. Flanks of worm engage concave rack underneath the table. A long spur gear drives the worm through engagement with teeth cut around the periphery.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

The Marketing Concept

During the last decade the marketing concept has grown and crystallized far beyond the concept of selling. Often the top official concerned with distribution is christened with a marketing title. He is looked to for commercial leadership, while within his official family is a manager of selling, among others.

There is ample need for a broader conception than that of selling. Applied research and production technology have multiplied products. Consumer processes increase and call for novel equipment. Industry's picture changes with automation, decentralization, and mergers. The industrial buyer looks to the supplier to exercise more skills and services—all well correlated. *Planning*, in addition to *doing*, demands greater attention, since present-day marketing decisions have a more pronounced effect upon profits.

So, at the start of the year, why not lift our sights and examine this rather new term and weigh its implications? Basically, the marketing concept has one broad objective. It is to achieve a more favorable competitive position by the use of every force available and to do so efficiently. There are seven components of marketing—commercial research, product planning, promotion, selling, product servicing, administrative services, and performance training. If correlated and made dynamic, these seven paths lead to marketing effectiveness by employing every resource and tapping even the most distant fellow employe to help win and hold customers.

Let us place these marketing concept components on the desk, and ask, "Is each one a vital concern?"

Market Research—These trite words often imply piling up a library of statistics, unrelated and unbalanced.

Repeatedly in selling we run into sales energy wasted because it was not properly directed, proportioned, and timed. And how often a loss of opportunity slaps us in the face because we had not discovered it was there, or recognized its importance. Market investigation can avoid these losses and failures.

Product Planning—Don't confuse product planning as a part of the marketing concept with engineering development, design, and production. The marketing concept can uncover customers' present and potential desires, give shape to new products and the need to improve old ones. It joins brains with those engineers who produce physical objects. Who has not seen equipment exploited which is tops in everything except salability? New products require "planned parenthood."

Sales Promotion and Advertising—Since its job is to inform, pre-sell, and help make purchasers satisfied, it has long had a chair in the marketing circle, but more recently this chair has moved closer in, employing more completely the crafts of communication!

Selling—Under marketing setup, selling is a less diffused operation. It is a game with well-defined ground rules and the clear-cut objective to get volume of profitable business economically. Selling is a *doing* job with the frills cut out. The sales engineer is the spearhead of the marketing family, unencumbered by marginal duties that make selling possible. Some remarkable crops have been harvested from old fields plowed deep.

Servicing—The product sold is distinctly a marketing function, for it secures sales made and customer satisfaction, and helps yield replacement part business.

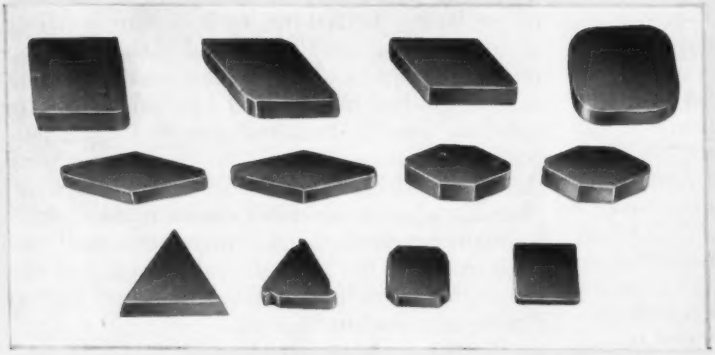
Administrative Services—Regulate and direct the operating systems that ultimately make the flow of orders efficient. Bettering systems reduces friction and waste.

Performance Training—Covers the gamut of marketing personnel. It includes selecting, instructing, and upgrading people.

Most any of us—especially at the New Year—can gain by clarifying our conception of marketing. Make a check to see which component is weak and what can be done to strengthen it. And make sure to clarify the marketing concept to every fellow employe, so he will share the belief that what he does can help advance the competitive position of the company.

MACHINERY'S Reference Section

January 1958



When and How to Use THROW-AWAY INSERTS for Cutting Tools

Thin inserts of carbide or oxide, which can be indexed and inverted in their holders to present sharp cutting edges, are becoming increasingly popular in the metalworking industry because they are cheaper to replace than regrind. In addition, machine setup time and down time are reduced to a minimum as a result of quick tool change-overs.

Compiled by CHARLES H. WICK
Managing Editor

THROW-AWAY INSERTS for cutting tools are relatively thin tips of carbide or oxide material that are mechanically clamped in holders of various design. Although such tools were introduced only a few years ago, their use has grown rapidly. A nation-wide survey of metalworking plants sponsored by the Wesson Co., Detroit, Mich., revealed that virtually two-thirds of the companies are currently using some single-point tool-holders having disposable inserts. In these plants, throw-aways represented approximately one-fourth of all the single-point tools employed on turning, boring, and milling equipment.

Why this phenomenal popularity? There are several reasons. One is the elimination of costly tool-grinding. Because they are mass produced by the manufacturers, their cost is relatively low; and it is cheaper to replace than regrind the inserts. When one cutting edge becomes dull, a sharp edge can be rapidly presented to the work by indexing the tip in the holder. If the tool-holder is designed for negative-rake cutting, the

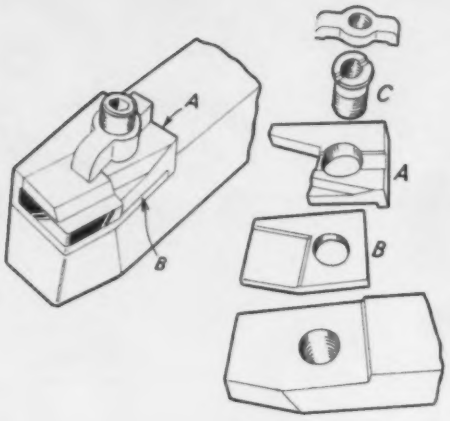


Fig. 1. Armstrong holder for throw-away tools has a replaceable tool-steel plate (A) that is cut away at the front for locating inserts.

inserts can also be inverted—thus doubling the number of cutting edges available. This number depends on the shape of the insert. For example, six cutting edges may theoretically be used on triangular bits and eight on square inserts. Even more edges are available with round inserts. However, full life cannot always be expected from inserts due to possible defects in the carbide, breakage, severe cratering, or chipping which may prevent or limit the amount of indexing possible.

Another major factor contributing to the rapidly increasing applications of throw-away tooling is the reduction in machine down time required for tool changes. The tips can be quickly indexed or inverted, and rapidly replaced when all of the cutting edges have been used. Accurate locating means are provided on various design holders so that different tips are held in the same relative cutting position within close limits without the need for tool adjustments, resetting, and trial-and-error machining.

A smaller inventory of cutting tools is another benefit experienced by users of throw-away tooling. Only a relatively few holders are necessary for various machining operations, and the inserts are interchangeable in different holders. For example, turning of both cast iron and steel can sometimes be done with the same holder by simply changing the grade of the carbide tip. However, a change in tool geometry is often required. Another advantage claimed for disposable tips is the practicability of using higher cutting speeds. This occurs because of the ability to use a harder grade of carbide than normally employed with brazed tooling; which, in turn, is due to the elimination of brazing stresses.

Elimination of grinding and lapping, if required, is particulary advantageous in the case of replacing brazed-tip tools where separate grinding of the steel shank and carbide tip are required. Chip-breaking on throw-away tooling is accomplished by means of beveled plates provided on most holders, and grooves for this purpose need not be ground into the inserts. Since the shanks of the holders do not have to be replaced, coolant connections can be made directly through the shank. In this way the coolant can be directed to the most desirable area, and the system lends itself to the use of liquid carbon dioxide as a coolant.

Cost per Cutting Edge is Low

The low cost per cutting edge can be appreciated from the following comparison with a typical brazed-tip, single-point cutting tool. Cost per cutting edge for brazed tools can be calculated from the formula:

$$\frac{\text{Original cost of tool} + (\text{number of regrinds} \times \text{cost per grind})}{\text{Number of regrinds} + 1}$$

Assuming the brazed tool cost $3.50, that it can be sharpened twenty-four times before a new tool is necessary, and the cost per sharpening is $0.50—the cost per cutting edge equals:

$$\frac{3.50 + (24 \times 0.50)}{24 + 1} = \$0.62$$

For throw-away tips, it is simply necessary to divide the cost per insert by the number of cutting edges. A square insert costing $0.80 and having eight cutting surfaces has a cost per cutting edge of only $0.10, plus the prorated cost of the holder

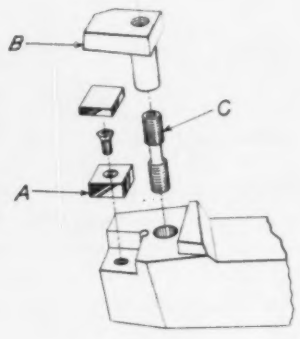


Fig. 2. Member (B) of this Carboloy Lift-O-Matic toolholder is carbide-faced and serves as both a chip-breaker and clamp.

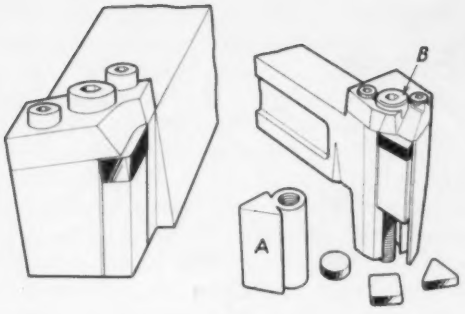


Fig. 3. Elevator block (A) on Vascoloy-Ramet tool-holders permits their use for either throw-away or regrindable inserts.

and replacement parts. While the original cost of a holder for throw-away inserts is generally higher than a brazed type holder, the cost per cutting edge for inserts is still very low when the holder cost is amortized over the period it can be assumed to be useful.

Lower expenditures for throw-away tooling are reflected in reduced cost per work-piece produced, savings in the cost of grinding wheels, and elimination of the risk of tool failure or short life due to incorrect grinding procedures. Also, additional savings result from less down time for tool changes and setup.

One firm conducted a six months' study of ordnance parts machining and found that throw-away inserts and tool-holders costing $1698 served the same purpose as conventional brazed tools costing $7820. In addition, there was an estimated saving of $6113 which would have been expended for resharpening. In another case, the cost of 432 brazed tools used to produce 5000 aircraft parts amounted to $1896. Resharpening, including grinding wheels, cost $4800, and machine setting time, $1200—resulting in a total cost of $7896, or $1.57 per part. Using throw-away inserts costing $1260, tool-holders amounting to $450, and taking into account $600 for indexing the inserts, the total cost for machining a second lot of 5000 work-pieces was only $2310, or $0.47 per part.

Limitations to the Use of Throw-Away Tools

The Wesson survey also showed that about three out of four companies in the metalworking industry are currently planning to increase their use of throw-aways. It has been estimated that the over-all applications of disposable-tip, single-point tools will grow from 16 per cent today to 40 per cent or more within the next few years. Some proponents predict that eventually throw-away tools will hold about 70 per cent of the carbide market.

However, this type of tooling is not suitable for all types of machining operations. To illustrate, throw-aways are not practical for special forms such as dovetail form tools. Another limitation is the relatively narrow range of tool geometry available with a specific holder. On the other hand, many different types of holders and inserts are now available. For example, Willey's Carbide Tool Co. is introducing a line of tool-holders for pentagonal-shaped inserts, which can be used instead of square inserts for all its applications except 90-degree grooving. Advantages of the pentagonal inserts for turning and facing are a 30-degree lead or approach angle and 12-degree back-clearance angle. Also, such inserts provide ten cutting edges.

While single-point throw-away inserts are available for positive-rake cutting, they can only be indexed, not inverted, in their holders—thus providing only half the number of cutting edges as a negative-rake insert of the same shape. Even so, their use is economically justified for some purposes. Positive-rake throw-away tools have been found particularly effective in machining slender shafts, thin steel sections, or non-ferrous parts.

Chip control can also be a problem with throw-away tooling. While some holders provide adjustable chip-breakers, the particular type and

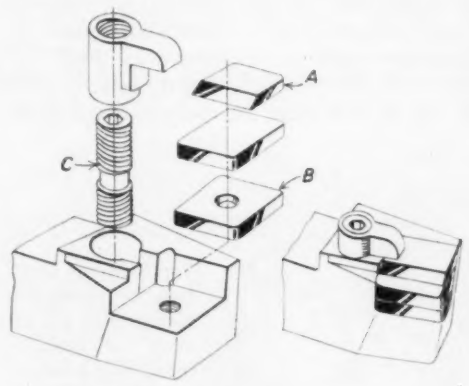


Fig. 4. Kendex tool-holders are provided with a socket-head screw (C) having left- and right-hand threads for clamping.

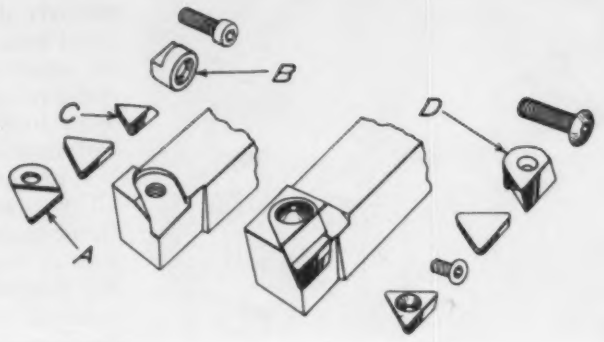


Fig. 5. Firth Sterling Thriftool (left) can be equipped with either a plain or a chip-breaker type clamp for holding inserts.

quality of chip desired for a specific operation cannot always be obtained. Of course, chip control can be obtained by varying the feed rate, but this is not always practical—especially in job-shop operations where predetermined speeds and feeds have been set up and incentive standards must be met.

Size of the user's plant seems to have little effect on the relative popularity of throw-away tools, although more large plants are currently using them. Shortage of manpower or lack of time to switch over are probably contributing factors that are slowing up their more widespread adoption. Also, the obsoleting and scrapping of existing mechanical holders is a deterrent to rapid conversion. However, whenever high grinding costs or excess machine down time for tool changes are being experienced, throw-away tools should be investigated.

Types of Inserts Available

Standard throw-away inserts for single-point turning generally have a triangular, square, or circular cross-section, in thicknesses of 1/8, 3/16, 1/4, 5/16, or 3/8 inch. Square inserts usually measure 3/8, 1/2, or 3/4 inch; mound tips are 3/8 or 1/2 inch in diameter; and triangular inserts have inscribed circle diameters of 1/4, 3/8, 1/2, or 5/8 inch. Most suppliers furnish the inserts in either precision or utility type grinds. Precision inserts for close-tolerance or finishing operations are accurately ground on all surfaces—top, bottom, and sides. The standard tolerance on the shape of the inserts is plus or minus 0.001 inch. However, some manufacturers hold a total tolerance of 0.001 inch. Utility inserts, available for about half the cost and recommended for roughing work, are ground on the top and bottom surfaces only.

Standards for throw-away inserts and holders have been developed by the A.S.T.E. National Carbide Standardization Committee and the Cemented Carbide Producers Association, and they are currently being circulated for possible adoption as an American Standard. This proposed standard covers dimensional specifications, styles, and designations of solid, sintered carbide inserts and their holders. Recommended standard radii vary from 1/32 to 5/32 inch depending on insert size, but tips are available with special radii. Selection of the proper corner radius is an important factor in the surface finish produced on the work.

While triangular, square, and circular inserts are most commonly used for single-point turning, other shapes, such as diamond and pentagonal, have been introduced.

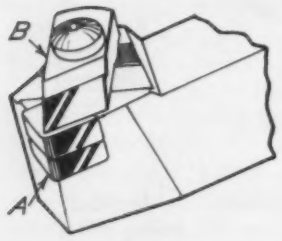


Fig. 6. Milled serrations on shank and clamp allow adjustment of carbide-faced chip-breakers on Adamas Dex-A-Tool holders.

Design of Single-Point Tool-Holders

Many types of single-point tool-holders have been developed for throw-away inserts. Carbide inserts and chip-breakers are held by finger-clamps on Armide single-point tool-holders made by Armstrong Brothers Tool Co. As seen in Fig. 1, the rear end of the clamp engages a slot in the upper face of a plate *A*, which is cut away at the front to provide locating surfaces for the insert.

This plate, together with a hardened and ground, replaceable tool-steel seat *B*, is fastened to the heat-treated alloy steel shank by a special screw *C*, which has a tapped center hole to accommodate the insert and chip-breaker clamp screw. A spring, not shown, is provided to lift the clamp, thus facilitating indexing of the insert.

The seat has a ground relief groove to provide clearance when an insert having built-up edges on one side is turned over to use the remaining cutting edges. Provision has also been made to clamp the insert directly, without the use of a chip-breaker, by swiveling the finger-clamp through 180 degrees. For triangular inserts, the cutting edge is parallel to the shank; while for square inserts, the cutting edge is at an angle of 15 degrees to the shank. The holder is designed to provide a negative-rake angle of 5 degrees. Armstrong also makes throw-away insert toolholders with narrow shanks, specifically designed to fit engine and toolroom lathe toolposts.

The clamping principle employed on Lift-O-Matic holders made by the Metallurgical Products Department of General Electric Co. is illustrated in Fig. 2. An indexable, tungsten-carbide pad *A* is screwed to the tool-holder shank to absorb shock and provide rigid support. The shank is made from medium- or high-carbon alloy steel heat-treated to a hardness of 38 to 42 Rockwell C to resist deformation, burring, and chip erosion. A carbide-faced combination chip-breaker and clamp *B* is available in interchangeable, standard or light-duty styles for chip control over a wide range of machining conditions. The surface of the chip-breaker portion is carbide coated and fused.

A single differential screw *C* is used to clamp and unclamp the insert. Socket-head recesses are provided in both the top and bottom of the screw to facilitate operation regardless of the holder position. By simply loosening this screw, the clamp is raised automatically so that the pad and insert can be quickly indexed or replaced without changing the tooling setup. Positive location is provided for the insert and pad by the recess in the holder shank, and the breaker-clamp is positioned by the stepped face on the shank. While the Carboloy holder shown is for square insert tips, similar tool-holders are available for round and triangular inserts. Also, the holders are made in various sizes and styles for straight or different lead angles, and for right- and left-hand cutting.

Examples of single-point tool-holders for throw-away inserts developed by the Vascoloy-Ramet Corporation are shown in Fig. 3. Holders of the same basic design are available for either 7-degree negative-rake or 6-degree positive-rake angles. A feature of these tools is an elevator block *A* (right) which permits using either thin, throw-away inserts, or 1 1/2-inch long inserts intended for resharpening. Holders are also available (left) without the elevator or lower shank extension for use with throw-away inserts only.

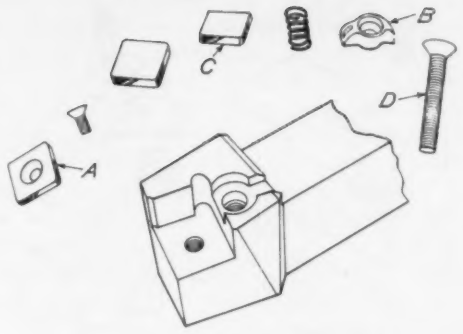


Fig. 7. Carmet holder has a clamp (B) that is located from a slot in the top of the tool-holder shank. Shim (A) is replaceable.

A combined chip-breaker and upper location plate, made of Tantung cast alloy, is fastened to the high-alloy steel body by two screws. Clamping of the insert against the under side of this plate is effected by the socket-head screw *B* which raises the block *A* in the shank.

The system of clamping employed for Kendex single-point tool-holders made by Kennametal, Inc., is shown in Fig. 4. A separate chip-breaker *A*, made of solid tungsten-carbide, is used in this type holder. The throw-away insert rests on a carbide shim *B* which is fastened in the locating recess of the alloy-steel shank by means of a single screw.

A toe-clamp that fits into a bored hole and key-

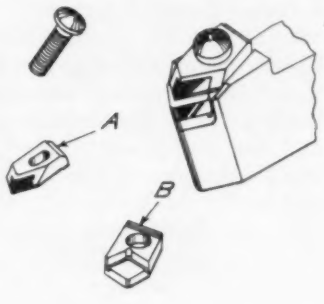


Fig. 8. Location of brazed carbide chip-breaker tip can be varied on this Wesson Multicut single-point toolholder.

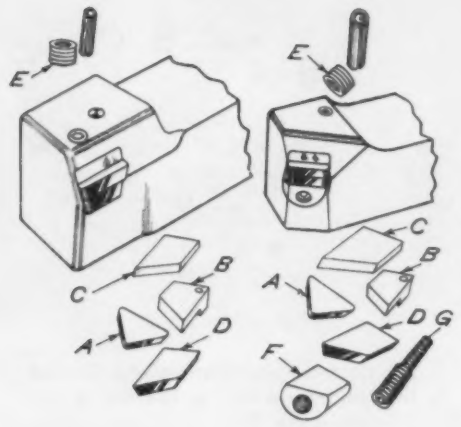


Fig. 9. Throw-away inserts, as well as anvils and chip-breakers, are clamped in broached slots on Viking tool-holders.

way in the holder shank secures the chip-breaker and insert in place. The clamp is tightened or loosened by a socket-head screw *C*, which has left- and right-hand threads and engages a threaded hole in the shank. Only a small angular movement of the screw is necessary, and when loosening, the clamp is raised clear of the insert for easy indexing. A hexagonal socket is provided in both ends of screw *C* to facilitate indexing or changing the insert when the holder is being used in an inverted position. Kendex holders are available in various types and designed for different-shape inserts. Also, the holders can be obtained for positioning the inserts to provide either a positive or a negative, 5-degree, side-rake angle.

In Firthite Thriftools, made by Firth Sterling, Inc., the throw-away inserts are held directly or indirectly in the recess of the holder by either a regular clamp or chip-breaker type clamp, depending upon the application. The insert rests on a recessed pocket surface or an anvil-locator, as seen at *A* in Fig. 5, for positive positioning. The regular clamp and chip-breaker clamp are interchangeable, and both are similar in appearance, as shown at *B*. The carbide chip-breaker insert *C* and the clamp are secured to the tool-holder shank by means of a socket-head cap-screw. The tool-holder shanks are plated to resist chip erosion. Tool-holders can be supplied for negative-rake cutting in the Thriftool design (left), or for positive-rake cutting in the Econodex tool-holder design, (right). The clamp for the positive-rake tool-holder is a combined, one-piece clamp and chip-breaker or solid carbide, as seen at *D*.

Another single-point tool-holder for throw-away inserts is the Dex-A-Tool, Fig. 6, made by the Adamas Carbide Corporation. The tip is supported on an invertible and indexable anvil *A* made from carbide or copper-plated, hardened tool steel. A combination chip-breaker and clamp *B* and button-head socket screw hold the insert in place. Milled serrations on top face of the shank and under side of the clamp permit adjustable but positive location in increments of 0.030 inch of the carbide-faced chip-breaker for various cuts.

The Adamas clamp also features two different styles—standard and set-screw. The set-screw chip-breaker clamp has a socket set-screw added to the head of the clamp which is adjustable against the clamp-locking screw. This feature permits more rapid chip-breaker relocation after indexing the tip. This set-screw passes in friction contact with a nylon plug to prevent its loosening under vibration. To index the insert, it is only necessary to loosen the clamp-locking screw one quarter turn. Interchangeable anvils allow using inserts (carbide or ceramic) having various radii and of different thicknesses in the same holder.

A clamp design that permits positive gripping

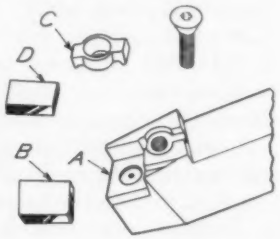


Fig. 10. Klamp-Lok holder has one end of clamp (C) recessed so that it can be used with or without chip-breaker (D).

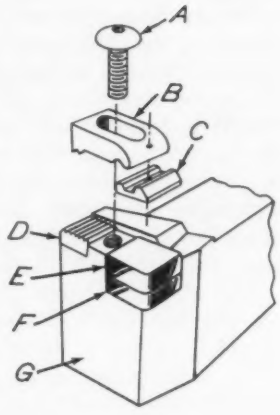


Fig. 11. Chip-breaker (C) is pinned to clamp (B) on this Valenite holder for throw-away inserts.

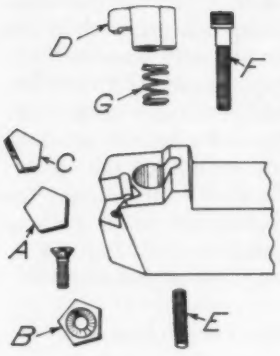


Fig. 12. Wil-Dex tool-holder provides an adjustable two-point support of the clamp.

action and allows good chip clearance is a feature of tool-holders for Indexables, produced by the Carmet Division of Allegheny Ludlum Steel Corporation. The replaceable shim *A*, which provides a high-strength seat for the indexable insert, is secured to the cadmium-plated, alloy-steel shank by a flat-head socket screw, Fig. 7. Clamp *B* firmly seats the insert, and can be used with or without chip-breaker *C*. The clamp screw *D* is accessible from both top and bottom of the holder by means of recessed heads at either end of the screw.

An adjustable, combination chip-breaker and clamp is a feature of the Multicut holders made by the Wesson Co. A carbide chip-breaker tip is brazed to the one-piece insert clamp *A* in Fig. 8. A relief is ground in the seat to clear any built-up edge on the insert. Adjustments for positive chip control are made by means of serrations on the under side of the clamp and the top face of the combination insert locator and anvil *B*. The range of adjustment extends from 0.050 inch from the cutting edge to 3/16 inch for larger inserts, and to 1/8 inch for smaller inserts. A single locking screw permits rapid adjustment, indexing, and replacing.

Single-point tool-holders for throw-away inserts made by the Viking Tool Co. feature broached slots. This company's Utiladex holder for triangular or square inserts with positive or negative rake is illustrated at the left in Fig. 9. The insert *A*, accurately located by means of a positioning grill *B*, is clamped between the chip-breaker *C* and carbide anvil *D* with a lock-screw *E*. By varying the distance from the cutting edge to the angular face of the chip-breaker, the chip action can be controlled. Similar holders are marketed by the Besly-Welles Corporation. In the Viking Supradex holder, seen at the right, the insert is locked by means of a tapered, semi-cylindrical wedge *F* that is actuated by a dual-threaded locking screw *G*. Viking is also developing a new-design holder in which the carbide anvil or shim will be attached to the holder with a screw, and the chip-breaker will be retained in the holder by a spring clip. This will be particularly advantageous for vertical tool applications in which the insert can be indexed and removed without disturbing other components.

Klamp-Lok tool-holders, Fig. 10, made by Metal Carbides Corporation, have a carbide shim *A* under the square, triangular, or round insert *B*. One end of clamp *C* has a shallow recess to accommodate the solid carbide chip-breaker *D*. When the tool is used without a chip-breaker, the clamp is simply reversed.

Throw-away insert holders made by Valenite Metals Division of the Valeron Corporation feature a short overhand for increased rigidity, and a low profile to facilitate application. Details of a typical Valenite holder are shown in Fig. 11. The clamp screw *A* has socket-head recesses at both ends for tightening from top or bottom. Clamp *B* is available in the serrated style shown, without serrations for infinite adjustment of the chip-breaker *C*, in a fixed-position style for single-purpose application, and without a chip-breaker

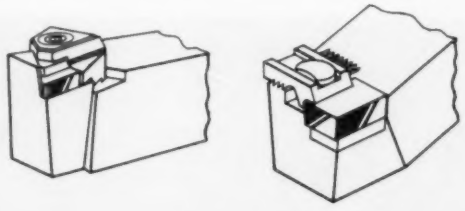


Fig. 13. Nu-Tool holder (left) and Ad-Clamp holder (right) made by Newcomer Products, Inc.

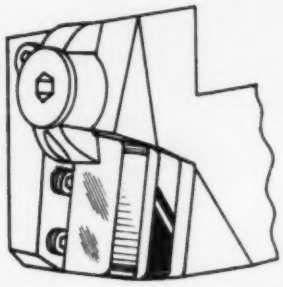


Fig. 14. Wendt-Sonis roller-turner tool-holder with throw-away inserts permits machining up to a 90-degree shoulder.

(for cast-iron and non-ferrous metal machining). The chip-breaker can be replaced without replacing the clamp, but is pinned to the clamp to avoid loss when changing inserts. Serrated-block *D* is a tool-steel section brazed to the heat-treated, tool-steel shank. Shim seat *E* is carbide and is provided in several standard thicknesses so that different inserts can be used.

Wil-Dex tool-holders, made by Willey's Carbide Tool Co., provide an adjustable two-point support of the clamp for positive clamping action with or without a chip-breaker. The support also keeps the clamp from tilting. As seen in Fig. 12, insert *A* rests on a shim *B*, which is fastened in the recess of the hardened alloy-steel shank by means of a screw. The solid carbide chip-breaker *C* is available in three different effective widths. Clamp *D* fits into a hole bored in the holder shank, with the semicircular heel preventing the clamp from rotating, and is supported by an adjustable set-screw *E*. A standard socket-head cap-screw *F* is used to fasten the clamp, and spring *G* facilitates indexing of the insert by lifting the clamp when screw *F* is loosened. While the holder is designed to provide negative back and side rakes of 5 degrees, it can be converted to a neutral rake or 10-degree negative rake (for heavy interrupted cuts) by replacing the standard shim with a special one.

Nu-Tool mechanical tool-holders, made by Newcomer Products, Inc., are available with or without a hardened anvil. A holder without an anvil is illustrated at the left in Fig. 13. This company also supplies Ad-Clamp holders, such as the one seen at the right, for use with standard rectangular inserts or step type blanks. With the latter holder, the adjustable serrated clamp locks the insert rigidly in place, and a built-in screw is provided for forward adjustment of the insert.

Roller-turner tool-holders with throw-away inserts for use on turret lathes are made by the Wendt-Sonis Co. With such a tool, Fig. 14, a zero-degree lead will cut to a 90-degree shoulder.

Production Uses of Throw-Aways

Turning of a 13-inch diameter by 3/4-inch thick steel plate on a Warner & Swasey No. 2A turret lathe at the Hyster Co., is illustrated in Fig. 15. A 5 3/8-inch diameter seamless steel tube is welded to the plate to form a carrier-trunnion. Facing and chamfering of the part is done in the same setup. Careful records have been maintained, and it was shown that throw-away tooling reduced tool costs to about one-fifth of that required for previously used brazed tools. The same grade carbide, Kennametal K21, was employed for both brazed and throw-away tools. Additional savings resulted from reduced down time, since the inserts can be indexed in seconds.

The average number of pieces produced per

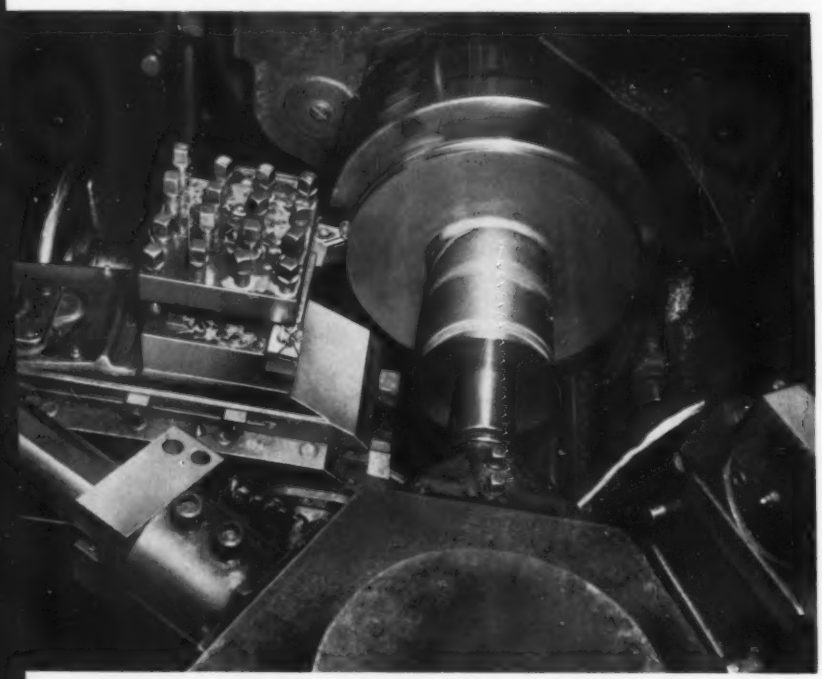


Fig. 15. Tooling costs were reduced to about one-fifth by switching to throw-away inserts for this turning and facing operation.

Kendex square, turn-over insert is 242.4, or 30.3 per cutting edge. This compares with eighty-eight pieces per brazed-tip tool, including nine regrinds. Turning is performed at 455 feet per minute (134 rpm) with a feed of 0.0054 inch per revolution and a depth of cut of 3/16 inch. Facing, performed with a triangular insert, is done at the same speed with a feed of 0.013 inch per revolution and a depth of cut of 1/4 inch.

In another application of Kennametal throw-away tooling, Fig. 16, 14 1/2-inch diameter, stainless-steel forgings are profiled in about one-third the time previously required with brazed tooling at the Carlton Forge Works. With brazed tools, this operation was performed at 600 surface feet per minute, with a feed of 0.010 inch per revolution. Two cuts were made to produce the required finish: a roughing cut 0.085 inch deep and a finishing cut 0.040 inch deep. Under these conditions, only four pieces could be profiled before the tool had to be sharpened, and total tool life was thirty-six pieces.

Now, with Kendex triangular inserts, the same speed and feed are used, but the full depth of cut (0.125 inch) is taken in one pass. To insure that the specified finish is obtained, the insert is indexed after profiling each part, and the insert is replaced after completing six pieces. Even so, tool cost per piece is only $0.092 for throw-away tooling, compared to $0.325 for brazed tools.

Solar Aircraft Co. has reported a 150 per cent increase in the number of parts produced with a single tool bit by changing to Carmet indexable blanks made by Allegheny Ludlum Steel Corporation. From 1200 to 1400 cuts can be made with a single blank before it needs to be replaced, and more than 80 jet-engine compressor cases can be produced with one insert. Previously, only 28 parts could be machined with one tool. Also, tool-changing time has been reduced 7 per cent with throw-away blanks.

Applications Other than Turning

Apart from turning operations, one of the most promising applications for throw-away inserts seems to be milling cutters. Since the grinding of milling cutters usually presents more of a problem than the sharpening of single-point tools, most companies are enthusiastic about their application. In many cases, the inserts can be indexed or inverted while the cutter is still in position on the machine. Also, if required, inserts of another grade carbide can be rapidly substituted to permit using the same cutter body for machining a different material.

The method of clamping throw-away inserts in the no-grind series of milling cutters made by the Wesson Co. is shown in Fig. 17. The head of socket-head screw *A* fits into a groove in wedge

Fig. 16. A roughing operation previously required in profiling this forging has been eliminated by employing throw-away tools.

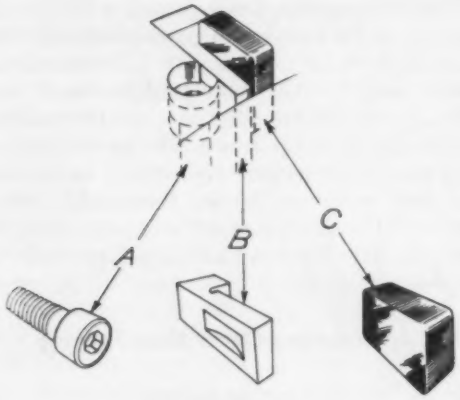


Fig. 17. On Wesson milling cutters, inserts (C) are locked by wedges (B) when the socket-head screws (A) are tightened.

B, thus locking it firmly against the square throw-away insert *C* when the screw is tightened. The throated wedge has a 15-degree angle and a concave top, and forms a smooth chip gullet. The screw is of special differential design for drawing the wedge into place, and has a left-hand, coarse-pitch thread on one end, and a right-hand fine-pitch thread on the other. Only one-half turn is needed to completely unlock or lock the insert. This design permits high-speed milling at rapid feed rates.

In one application, SAE 1020 steel slabs are milled with a 12-blade, throw-away insert cutter at 1250 feet per minute (1200 rpm), with a depth of cut of 0.187 inch and a feed rate of 30 inches per minute. Negative radial and axial rakes of 7 degrees are automatically provided by the slots, and each insert can be indexed to each of its eight cutting edges before being discarded. A reserve inventory of cutter bodies is not required, and efficient milling of both cast iron and steel are possible with the same body simply by using different grade carbide inserts. The cutters can be used with existing adapters and machines. Positive blade location is obtained by placing a ring gage against the cutter face, and the inserts are aligned by bringing them into contact with the gage and locking them in position by tightening the screws.

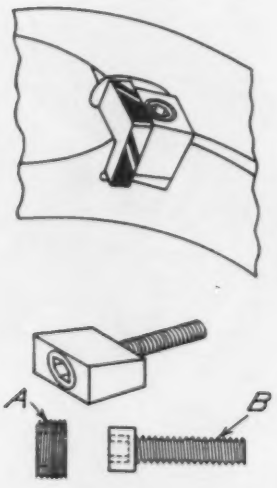


Fig. 18. Tapered square wedges clamp the indexable, throw-away inserts on Futurmill milling cutters.

On milling cutters made by Futurmill, Inc., for double positive- or double negative-rake cutting, the indexable, throw-away inserts are clamped by tapered square wedges. As seen in Fig. 18, the wedges are placed behind the inserts for rigidity and to protect the cutter body in case of a smash-up. The wedges draw the blades inward as they are tightened with a T-wrench. This wrench goes right through the hole in the removable lock-screw *A*, and into the socket cap-screw *B*. It is unnecessary to adjust the removable locking screw, since its only function is to permit the replacement of a socket cap-screw that becomes worn or stripped.

Featured in the shell end and face mills manufactured by McCrosky Tool Corporation is the Super-Jack, a patented blade-locking device which rigidly holds the square and triangular inserts without the need for threads in the bodies. Tightening of the self-contained, Super-Jack wedge *A* (Fig. 19), locks the carbide chip-deflector *B* and throw-away insert *C* securely in the cutter body. The heat-treated alloy steel body of these cutters is made in two parts to permit all the bearing surfaces for the carbide inserts to be ground accurately. Each wedge is assembled permanently into a single unit that occupies a semicircular recess in the cutter body, in front of the chip-deflector and blade. Turning of the wedge screw to the right expands the wedge horizontally, thus locking the chip-deflector and insert, and no pressure is exerted against the bottom of the recess.

Milling cutters made by Newcomer Products, Inc., feature a two-piece body construction, and the throw-away insert blades rest on carbide blade stops, anvils, and wear-plates so that they do not contact the steel body. As illustrated in Fig. 20, throw-away insert *A* is supported on a carbide blade stop *B* mounted on the inner cutter

body member *C*, and a similar stop *D* on the outer body member *E*. Also, the insert is clamped against a carbide anvil *F* by a C-lock and carbide wear-plate assembly *G*.

Several companies are making face mills in their own toolrooms, using standard single-point, throw-away insert tool-holders. For example, Viking Mfg. Co., manufacturers of farm machinery, are using 12-inch diameter face mills, made from eight Kendex single-point tool-holders having square, turn-over button inserts, Fig. 21. The top surfaces of the holders are in planes passing through the center of the cutter body. Each holder is clamped by a pair of set-screws contained in channels in the body periphery.

These cutters are used for face-milling the mating surfaces of cast-iron transmission housings, 8 1/2 inches long by 12 1/2 inches wide. They are operated at 390 surface feet per minute (124 rpm), with a feed rate of 4 1/2 inches per minute and a depth of cut of 1/16 to 5/32 inch. Milling is completed in one pass in only nine minutes floor-to-floor time. From fifty to sixty parts are milled with each cutting edge, and since each insert provides eight edges, from 400 to 480 pieces are completed before the insert set is replaced. Indexing time for all eight inserts is only twenty minutes. Previously, a 3-inch diameter, high-speed steel end-mill was traversed around each gasket flange at the rate of 2 inches per minute. This required about twenty-one minutes, and the cutter had to be resharpened (requiring about one and one-half hours) after completing twenty-five castings.

After conducting numerous experiments and extensive tests, the Convair Division of General Dynamics Corporation adopted throw-away insert type tooling for all turning and facing operations, as well as 60 per cent of the face-milling setups, in producing parts for the F-102A airplane. In milling alone, the company expects to save $35,000 per year over previously used brazed cutters—plus additional benefits from higher speeds and feeds. Throw-away inserts for milling are provided with chamfered rather than rounded corners for less heat generation. Fig. 22 illustrates a typical milling operation with a Vascoloy-Ramet cutter having five square bits. In this setup, SAE 4130 steel is being milled at 270 feet per minute, with a depth of cut of 1/4 inch and a feed rate of 0.006 inch per revolution.

At Convair, cutting speeds with throw-away tooling vary from 200 feet per minute for cutting titanium alloys, to 800 feet per minute for high-temperature resistant materials. For machining aluminum, the only limit is the available speeds on the machine.

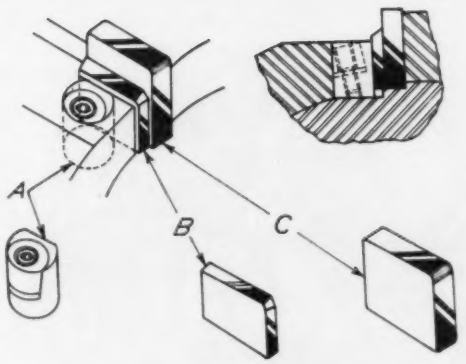


Fig. 19. Super-Jack blade-locking devices hold inserts in McCrosky milling cutters without threads in bodies.

Boring with Throw-Aways

Another machining field in which throw-away inserts are becoming increasingly popular is boring. In one application, an automotive plant has cut costs to less than one-fourth that previously required for brazed tools. This operation consists of boring holes 8 inches in diameter through 3/4-inch thick steel clutch plates. Formerly, only twelve plates could be bored per tool grind, and ninety-six pieces per tool. Now, thirty-one parts are bored with each of the eight cutting edges—giving a total of 248 plates per insert. Comparative tooling costs showed that the cost per piece was 3.8 cents with brazed tools, and only 0.78 cent with inserts. Boring with both type tools was done at 280 surface feet per minute (134 rpm) with a feed rate of 0.011 inch per revolution and a 3/16-inch deep cut.

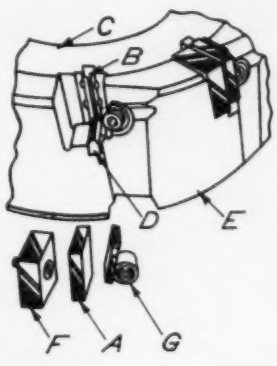


Fig. 20. Newcomer milling cutters feature carbide blade stops (B) and (D) for supporting insert (A).

Fig. 21. Face-milling cutter made in user's own tool-room from eight Kendex single-point tool-holders having square, turn-over inserts.

A line of standard micro-adjustable boring tools for throw-away inserts are available from the Wesson Co. The tools are fitted with a vernier screw adjustment for setting the diameter to be bored. Each of the twenty graduations on the circular dial represents an advance or retraction of the insert of 0.001 inch. Means of clamping and design features are the same as this company's single-point throw-away tools. Relief grinding below the cutting edge is avoided by locating the cutting edge of the insert slightly above center. Such tools, equipped with a special anvil-locator, are adaptable to internal threading operations, using standard triangular inserts. Changing from triangular to round or square inserts requires only the interchange of the anvil. Multiple-diameter boring operations can be combined and chamfering performed with the same tool by arranging such micro-adjustable tools as seen in Fig. 23.

Valenite micro-adjustable boring units, using positive-rake, throw-away inserts, are employed in the boring-bar seen in Fig. 24. This boring-bar, designed and built by the Modco Tools Division of Valeron Corporation, is used for profile boring an automotive power-steering housing. The adjustable boring units are held in broached slots in the bar.

Another interesting application recently introduced by Kennametal is a multiple-insert grooving tool, containing twelve round button inserts, each 1/2 inch in diameter. Throw-away inserts, ground to the thickness of the required grooves and with their corners left sharp, are set on edge in the special grooving tool-holder seen in Fig. 25. This holder, made by Modco Tools, is used to groove transmission input shafts for automotive engines. Considerable time is saved by having only to index the inserts, instead of replacing and adjusting the holder.

A special Modco combination facing, boring, and chamfering tool-holder is shown in Fig. 26. Mounted on the unit are a total of nine rectangular throw-away inserts (six long and three short) for facing; an adjustable holder with a

Fig. 22. Throw-away insert milling cutter being used to cut SAE 4130 steel at 270 feet per minute with a feed of 0.006 inch per revolution.

triangular, indexable insert for chamfering; and a Valenite micro-adjustable holder with a throw-away insert for boring. This tool is used on a Heald precision Borematic for machining automotive transmission extensions.

Yet another special application of throw-away inserts is a Modco trepanning cutter, Fig. 27. The cutter has an overall length of 18 1/16 inches, with the smaller tool (shown disassembled at the left) measuring 5 5/16 inches in diameter and the larger tool, 8 1/4 inches in diameter. This tool is used on a Baker vertical, rotary indexing machine for aluminum alloy automatic transmission housings. A cutting speed of 2800 surface feet per minute (1800 rpm) is employed, with a feed rate of 0.036 inch per revolution.

Contemplated future applications for throw-away inserts include reamers, drills, form cutters, and broaches.

Changing Over to Throw-Away Tooling

In converting a plant to the use of throw-away tooling, all machining operations should be surveyed for possible applications, and all new tool requisitions should be screened. A good starting point in the change-over would be operations requiring an excessive amount of time for setup or tool replacements, or for which the tool grinding costs are abnormally high. Normally, throw-away tooling can be used successfully on high-production automatic machines, for heavy-duty operations, where high stock removal rates are required, and for finishing operations where hard grades of carbide are employed. On the other hand, such tooling may not be as successful for close-tolerance facing cuts, interrupted cuts, heavily scaled work-pieces, and operations on machines in poor condition.

Cost comparison is the best way to insure economical replacement. Pertinent facts such as the initial cost, the number of parts produced before regrinding is necessary, and the tool-changing time can easily be obtained for existing tooling, and the cost of throw-away tooling can be estimated. After replacement, the setup should be checked periodically to insure satisfactory operation and to determine whether the expected savings are being realized.

In general, negative-rake throw-away tools can be used for practically all operations and materials with the possible exceptions of boring operations, small-diameter turning, thin-section facing, operations on long slender shafts, and some non-ferrous alloy machining. To minimize the inventory required, inserts of only one thickness should be specified if possible.

The inventory of throw-away inserts can be a problem because the inserts of different manufacturers, regardless of grade, look alike. This can lead to misuse by applying the wrong tool grade to the material being worked. Various suppliers now provide permanently marked throw-away blanks. For example, the Carmet Division of Allegheny Ludlum Steel Corporation presses designations of different shapes 1/64 inch deep into the face of the blanks to identify various grades. Also, some users are color coding the inserts to facilitate identification.

Training of machine operators and setup men for the use of throw-away tool-holders is a minor problem but an essential requirement. This can be accomplished by a few demonstrations or classroom meetings to explain how the tools

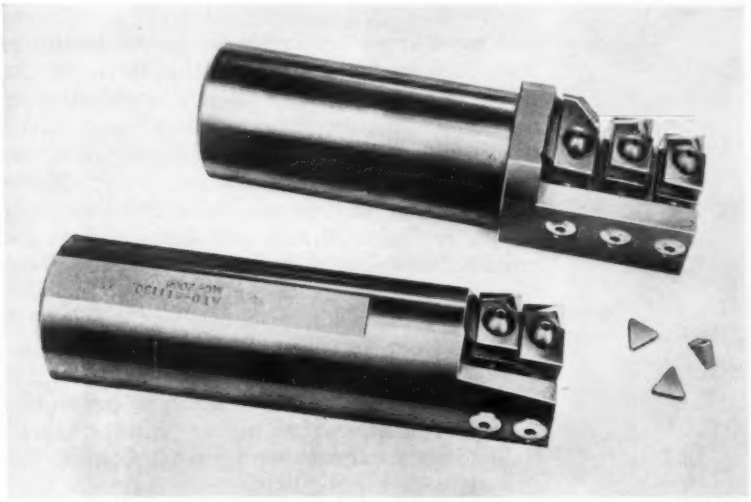


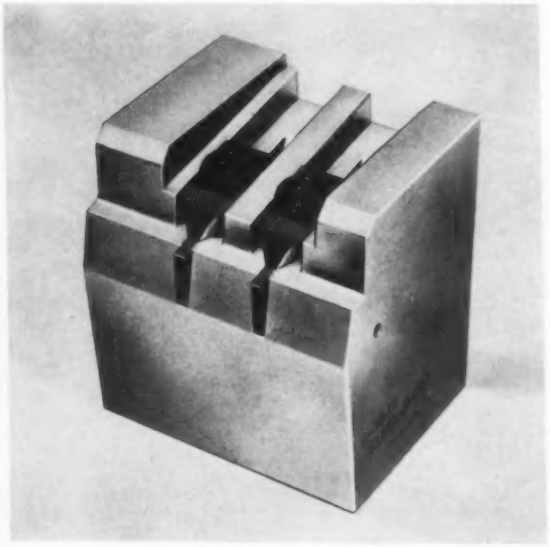
Fig. 23. Multiple-diameter boring tools equipped with micro-adjustable throw-away inserts. Graduations represent 0.001 inch.

Fig. 24. (Right) Modco boring-bar having broached slots for holding Valenite micro-adjustable boring units.

Fig. 25. (Below) Special grooving tool-holder in which the indexable, throw-away inserts are set on their edges.

should be handled and operated. Speed and feed charts should be made available, as well as recommendations of insert grades for machining various materials. Misapplication of standard holders, due to lack of proper indoctrination of the operators, has caused some trouble.

The same general recommendations for the use of brazed or mechanically clamped carbide tools apply to throw-aways except that the cutting speed can normally be slightly higher. For example, good tool design practices, rigid machines, and adequate tool support are desirable. Usually, throw-away inserts can be one grade harder than were previously used for brazed tools. Some manufacturers recommend honing of the insert edges before using, as a means of increasing tool life and reducing the possibility of chipping.



A most important factor in the use of throw-away tool-holders is to insure that the insert lies flat in intimate contact with an adequate backup member. Dirt, burs, or foreign bodies between the insert and backup member can interfere with proper seating. In the event of damage, the holder should be removed or inspected carefully before replacing the insert, since a damaged anvil or holder could result in early failure of the new insert. The insert pockets in the tool-holders, as well as the clamps, screws, and anvils, will become worn and should be replaced periodically if excessive breakage is encountered or if it becomes difficult to maintain the proper angles and specified tolerances. In some cases, it is possible to repair the holders by building up the pockets with brazing or metal spraying.

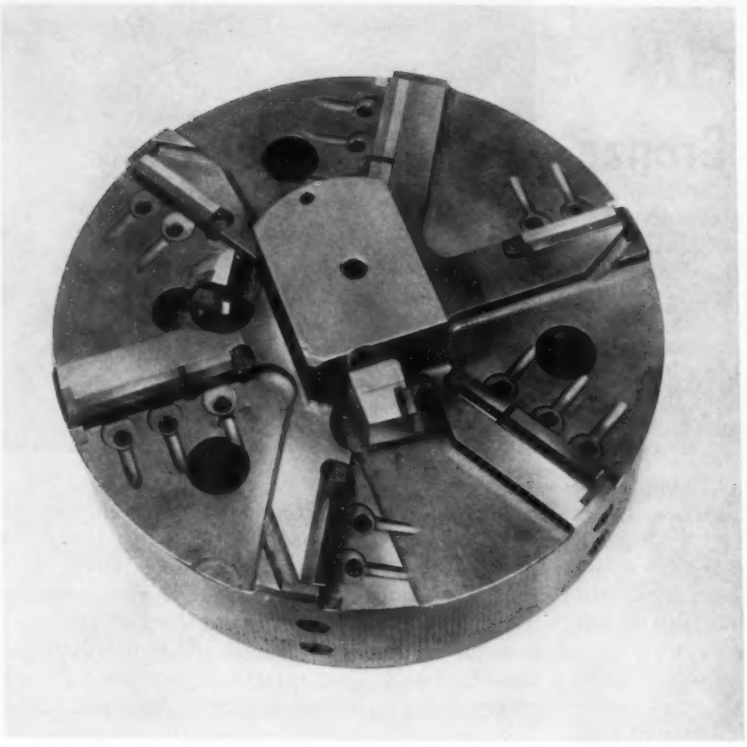


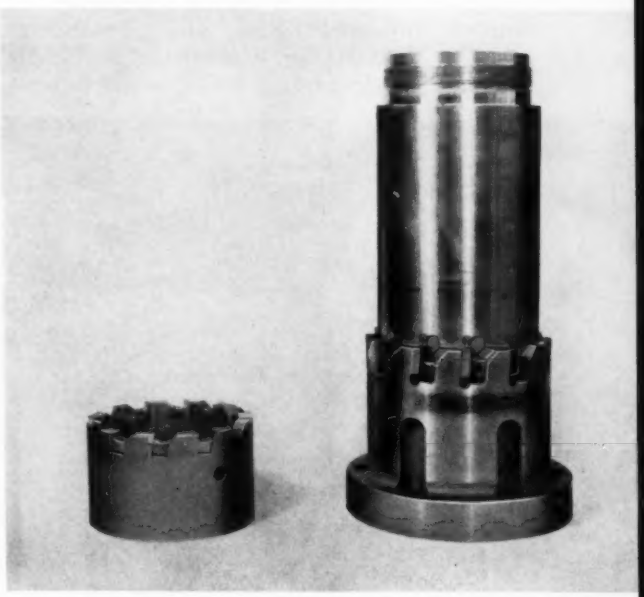
Fig. 26. (Left) Modco combination facing, boring, and chamfering toolholder for machining transmission extensions.

Fig. 27. (Below) Trepanning cutter with two sets of indexable, throw-away inserts for machining transmission housings.

Periodic Indexing Should be Emphasized

The answer to the question of when to index a throw-away insert depends on the requirements of the specific operation. There is a tendency not to index inserts as long as the workpieces produced are within tolerance, but certainly it should be done before the edge becomes too dull. Some plants prefer to have the operator index the insert after a predetermined number of parts have been machined. Others recommend indexing after a maximum wear land of 0.030 inch has been developed on the insert. This latter specification may vary from 0.015 to 0.050 inch, depending on the work being done. At Convair, it is common practice to remove about 200 cubic inches of material before indexing the insert to present a fresh cutting edge, when machining materials such as SAE 4340 steel alloy with a depth of cut of 0.350 inch and a surface speed of 500 feet per minute.

It is not generally recommended that worn inserts be re-used for brazed tools. Such practice is not usually economical and defeats the purpose of eliminating grinding costs. However, if brazed tools having similar-size tips are required for other operations, this procedure may be practical. Also, the straight sides of used inserts having worn corners can sometimes be used for chamfering or facing operations. Some users have found it to be economical to return inserts with worn corners to the manufacturer, who can extend their life by grinding larger radii on them.



Turbine Production Facilitated with Continuous-Cast Bronze

CHANGE-OVER to a continuous-cast bronze alloy is attributed as the reason for a 6 per cent production increase over an eighteen-month period at the Coppus Engineering Corporation, Worcester, Mass. The company uses the cast alloy in the production of steam turbines for the petroleum and petro-chemical industries. Throw rings, partition plates, shaft and safety trip collars, valve seats, and nozzles are typical of the turbine parts involved in the material substitution, with recorded savings on individual components ranging from 30 to 50 per cent.

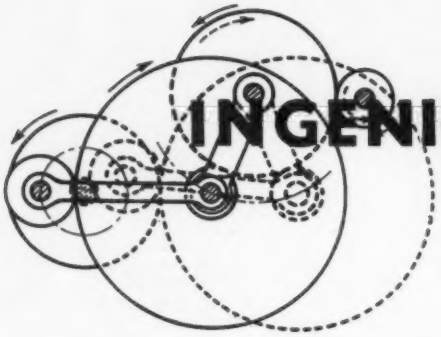
Supplied in diameters closely approximating those of the finished parts (Fig. 1), the continuous-cast bronze alloy, Asarcon 773, is cast with a special process by the American Smelting & Refining Co. Only 1/32 inch is removed on parts up to 4 inches in diameter, 1/16 inch on 4- to 5-inch diameter parts, and 3/32 inch on parts with diameters from 5 to 9 inches. This results in a considerable savings in material and machining time with certain operations being completely eliminated.

In the machine shop, bars of continuous-cast bronze 105 inches long are fed directly into turret lathes. Surfaces are finished to the specified diameters, and the completed parts are cut off the cast piece. Then the remaining length is moved forward in the lathe, repositioned, and the production cycle is repeated. This arrangement was impossible with the short-length sand castings formerly used, and additional material was wasted by scrappage of the unused end pieces. For machining certain turbine parts, the bars are cut to convenient lengths, as shown in Fig. 2.

Since adopting the continuous-cast bronze material, no parts have been rejected because of porosity or other imperfections in the metal. Previously, especially in the case of nozzles, flaws in the metal had caused the scrapping of parts after several machining operations had been completed. As the bars are uniform in weight and length and are free from burrs and fins, the continuous-cast material is safer and easier to handle and store.

Fig. 1. (Above) Continuous-cast bronze stock (right) is supplied with cast surfaces within 1/32 to 3/32 inch of the finished diameter, depending on the size. Sand casting is at left.

Fig. 2. (Left) Machinist is shown cutting a bar of continuous-cast bronze into lengths suitable for fabricating several different turbine parts. The material is supplied in bars 105 inches long.



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Geared Speed Reducer Changeable under Load

J. Boas Popper, Kfar-Ata, Israel

A geared speed-reducing mechanism that can be regulated to obtain any one of sixteen different ratios without disengaging the input load is here illustrated. Changing of the speed ratio is accomplished with the gears in any position and while they are idle or in motion. Slippage will not occur if the torque transmitted is below a certain predetermined magnitude, but any overloading of short duration is cushioned by a spring-loaded shock-absorbing arrangement.

The mechanism (Fig. 1) consists of four similarly constructed gear-boxes A, A_1, A_2, and A_3 mounted in-line vertically with the output of each unit being the input to the one immediately above. Each gear-box can be operated at either of two speed ratios, one of which is 1 to 1. The second gear ratio for each unit is as follows: 1.5 to 1 for A, 2 to 1 for A_1, 4 to 1 for A_2, and 16 to 1 for A_3.* With this choice of speed ratios for the individual gear-boxes, sixteen different speed reductions ranging from 1 to 1 up to 192 to 1 are possible when the units are combined in a single four-stage mechanism. The speed ratio of an individual unit is changed by means of a selector knob B mounted on each gear-box. How the speed ratios of the four individual gear-boxes are combined to obtain the available speed reductions is shown in the accompanying table.

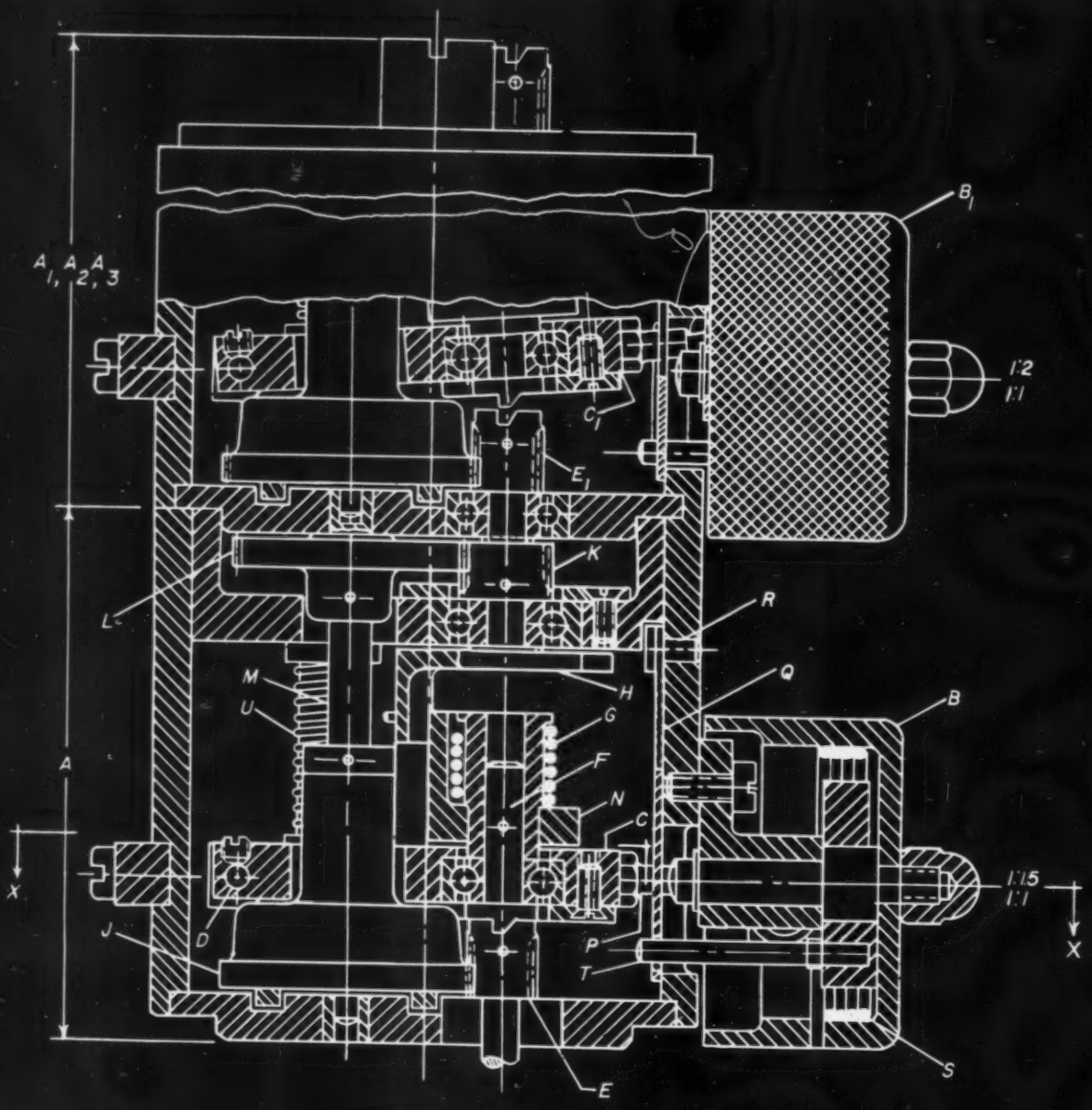
Lower gear-box A is set to operate at a speed ratio of 1 to 1 when lever C, which pivots on pin D, is in the lowered position as shown in Fig. 1. In this case, the motion of the input shaft and gear E is transmitted through a positive clutch to shaft F. Spring G further transmits the motion to member H which is a section of a cylindrical cup. Member H is mounted on the same shaft as the input gear E_1 for gear-box A_1. In addition, the motion of gear E is transmitted to gear J, and the motion of member H is transmitted through gears K and L to shaft M. An over-running clutch prevents shaft M from becoming coupled to gear J. This arrangement is possible since the shaft rotates faster than the gear.

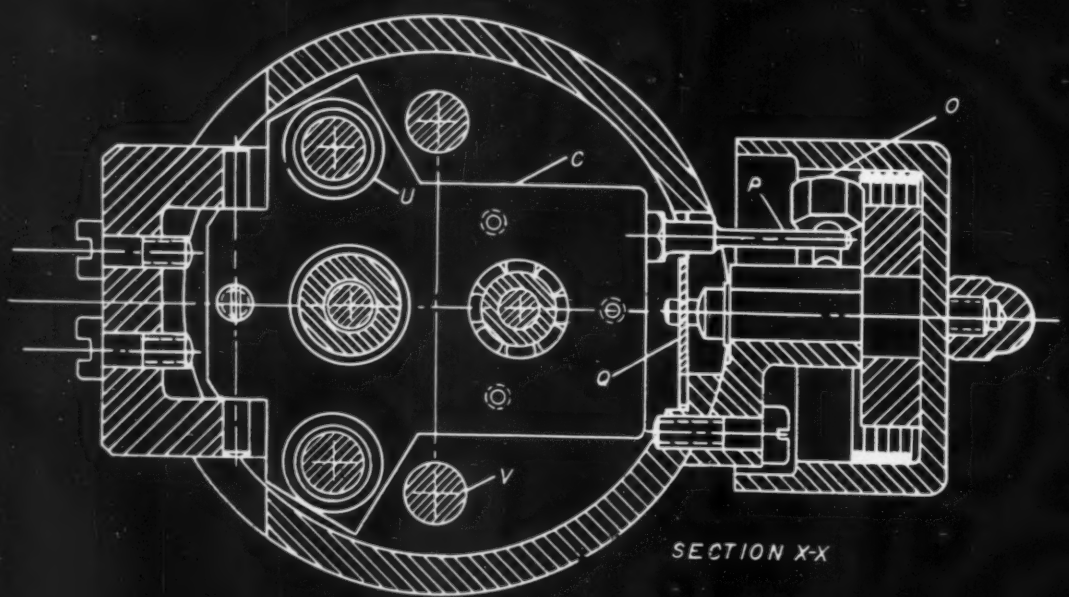
The over-running clutch, illustrated in Fig. 2, consists of two rollers that revolve with shaft M inside a bushed hole in gear J. (Rotation of both gear and shaft is always in the direction indicated.) If the shaft rotates faster than the gear, the rollers move freely with the shaft. Retainers in the form of thin leaf springs are bolted to the shaft to hold the rollers in place. When shaft F is disconnected from member E, the drive slows in rotation until the relative motion between gear J and shaft M is in the opposite direction. At that instant, the angular flats on the shaft force the rollers outward until they become wedged against the gear, which will then become the driving member. This is accomplished immedi-

How Speed Ratios of Individual Gear-Boxes are Selected to Obtain Sixteen Speed Reductions

Over-All Speed Reduction	Speed Ratio of Individual Gear-Boxes			
	A	A_1	A_2	A_3
1 to 1	1 to 1	1 to 1	1 to 1	1 to 1
1.5 to 1	1.5 to 1	1 to 1	1 to 1	1 to 1
2 to 1	1 to 1	2 to 1	1 to 1	1 to 1
3 to 1	1.5 to 1	2 to 1	1 to 1	1 to 1
4 to 1	1 to 1	1 to 1	4 to 1	1 to 1
6 to 1	1.5 to 1	1 to 1	4 to 1	1 to 1
8 to 1	1 to 1	2 to 1	4 to 1	1 to 1
12 to 1	1.5 to 1	2 to 1	4 to 1	1 to 1
16 to 1	1 to 1	1 to 1	1 to 1	16 to 1
24 to 1	1.5 to 1	1 to 1	1 to 1	16 to 1
32 to 1	1 to 1	2 to 1	1 to 1	16 to 1
48 to 1	1.5 to 1	2 to 1	1 to 1	16 to 1
64 to 1	1 to 1	1 to 1	4 to 1	16 to 1
96 to 1	1.5 to 1	1 to 1	4 to 1	16 to 1
128 to 1	1 to 1	2 to 1	4 to 1	16 to 1
192 to 1	1.5 to 1	2 to 1	4 to 1	16 to 1

*This idea, suggested by H. Eisenberg, Weizmann Institute of Science, Israel, was included in a patent application.





SECTION X-X

ately and practically no relative motion in the opposite direction is obtained.

When the selector knob is turned to obtain speed reduction, the lever C is pivoted to the raised position and the positive clutch is disengaged. Lever C_1 is seen in the raised position in Fig. 1. With this arrangement, the motion of gear J is transmitted to the output shaft and gear E_1 through the over-running clutch, shaft M, gear L, and gear K. When lever C is lowered to change back to the 1 to 1 ratio, output gear E_1 is again driven through the positive clutch, shaft F, spring G, and member H. The drive through the over-running clutch becomes uncoupled as shaft M again rotates faster than gear J.

The purpose of part N is to tension spring G so as to transmit only a predetermined safe torque without deflecting. Momentary loads greater than this value will cause the spring to deflect and thus cushion the shock to the mechanism. A shock load may occur as lever C is lowered to shift to the 1 to 1 speed ratio. Enough clearance is provided between parts N and H to prevent interference when lever C is in the raised position.

Since gears J and E are in a 4 to 1 speed ratio for all four units, the ratio of each gear-box is varied only by the choice of gears K and L. In addition, gears K and L are selected to make the distance between their centers the same in all units.

When knob B is turned counterclockwise, bolt O lifts lever C to the raised position and the drive is immediately shifted to a lower speed. Lever C is secured in this position since an integral arm P is held by latch Q which pivots on headed pin R. Spring S, pin T, and its retaining collar rotate counterclockwise with the knob. Pin T rotates latch Q so that a protrusion on this member is hooked under arm P. Spring S also holds the knob in the position in which it was set. Two springs U push lever C down and provide the necessary pressure to keep arm P hooked in place.

Shifting back to a higher speed ratio is accomplished by turning knob B clockwise. Bolt O, rotating with the knob, pushes latch Q aside and releases arm P. Springs U, in turn, push lever C to the lowered position, and shaft F becomes coupled to the input gear E by means of the positive clutch.

The gear-boxes are held together by means of threaded studs V which are about the length of each unit. Two studs are secured in threaded holes provided in the bottom plate of the first unit. These studs protrude a short distance through clearance holes in the bottom plate of the second unit, and short tubes with internal threads and slotted ends serve as nuts to tighten the units together. Each threaded tube is long enough to accept the stud for securing the next unit.

Fig. 1. (Opposite page) Gear ratio of this four-unit speed-reducing mechanism can be changed while operating under load. Sixteen different ratios are possible.

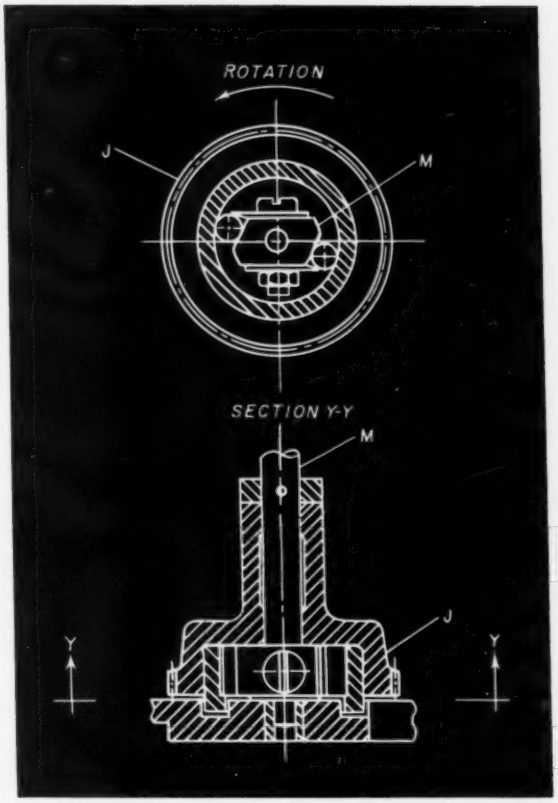


Fig. 2. Here the over-running clutch that prevents loss of load when speed ratio is changed is seen in detail.

In operation, response of the mechanism is instantaneous when shifting any individual unit to a lower speed. Response to the changing of any unit to a higher speed (that is to the 1 to 1 ratio) is not instantaneous, as a very slight delay is necessary for the positive clutch and spring G to become driving members. Use of the over-running clutch, however, keeps the drive operating under load until it is shifted to these members. The mechanism can be driven in only one direction but it is possible to make the output reversible by adding a special gear-box with operating ratios of 1 to 1 and -1 to 1.

This speed-reducing unit was originally made for use with a viscosity meter but can be applied wherever gear shifting without a neutral position is essential.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Automatic Blank Feed for Forming Dies

FEDERICO STRASSER, Santiago, Chile

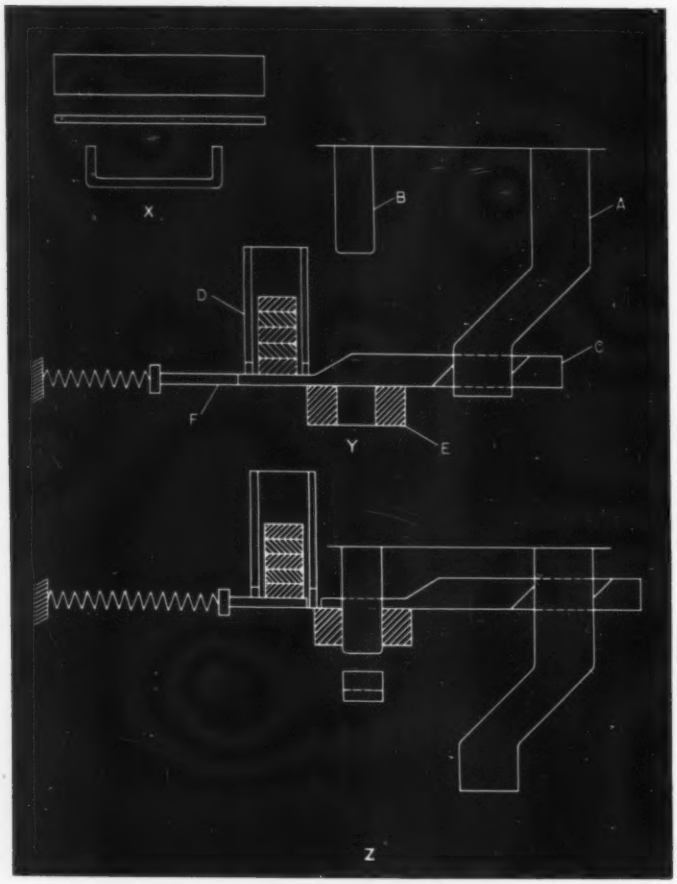
A cam, a slide, and a magazine automate the feeding of flat blanks to a punch press. In the illustration, view X shows the blank and the channel to which it is formed by the operation.

The positions occupied by the components when the ram has completed its up stroke are shown in view Y. Cam *A*, operating with punch *B*, passes through an open area in slide *C*. Magazine *D* forms a bridge over the opposite end of the slide. There is a second open area in the slide, which is a nest for the lowermost blank in the magazine.

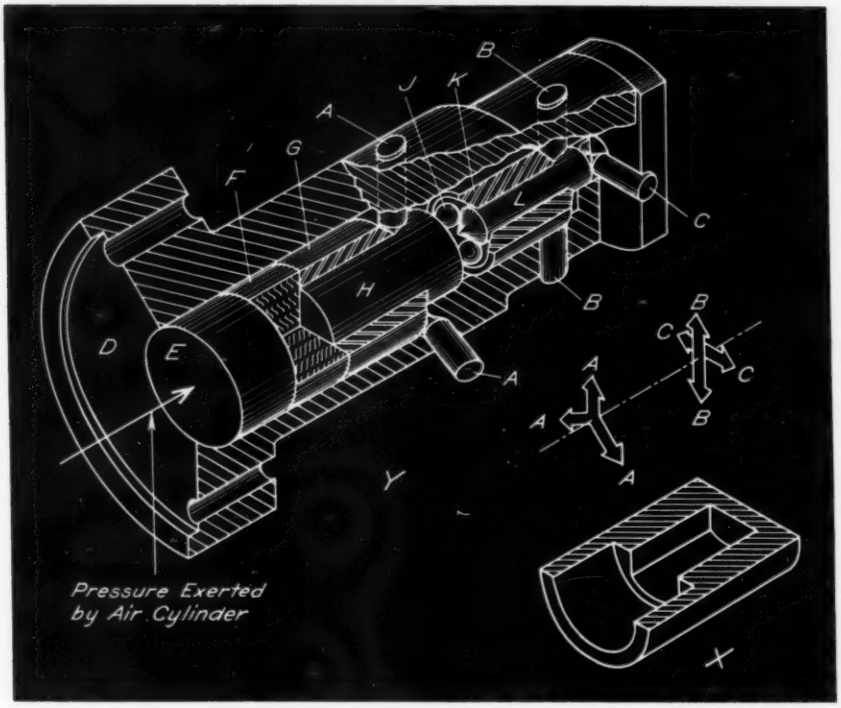
As the ram descends, the slide, with a blank in its nest, is first pulled in rapidly until the blank is aligned with the punch *B* and die *E*. Continued descent of the ram does not further move the slide, and the punch forms the blank, pushing it out of the bottom of the die, as in view Z.

The magazine has a spring-loaded movable bottom *F* which keeps the blanks from falling out. On the down stroke, the spring forces the bottom under the magazine as the slide moves into the press. On the up stroke, the slide displaces the bottom, and a new blank drops into the nest.

Because the work is ejected below the die and because of the presence of the cam, the press must have a stroke greater than would ordinarily be required. Both the slide end and the movable bottom should be lower in height than the thickness of the blank. Conversely, the bridge clearance of the magazine should be greater than the thickness of the blank. This is necessary for the smooth operation of the device.



On the down stroke, cam (A) pulls slide (C) into the press. Then punch (B) pushes the blank through die (E)



Equalizing plungers in air-actuated mandrel will grip within rough castings regardless of variations from one cored hole to the next.

Pneumatic Lathe Mandrel Compensates for Component Variations

G. R. TINDALE, Hazelwood Park, South Australia

A cylindrical sand casting, such as the one shown at X in the accompanying illustration, required machining to bring the periphery concentric with the cored cavity. The cavity is circular in shape at the open end, changing to a smaller circular shape having two opposing flats at the closed end. Due to variations in the dimensions of the rough-cored hole, concentricity could not be maintained by locating from fixed mandrel points.

Consequently, the pneumatically operated mandrel at Y was designed to provide a three-point, self-centering arrangement *A* for the open end of the cavity, and two sets of equalizing plungers *B* and *C* for the closed end. Compensation has been provided to permit plunger conformity to shape variations of the cored holes.

Mandrel body *D* is bolted to the spindle nose of the lathe. The interior of the mandrel body is bored out to receive the clamping mechanism which is operated by an air-cylinder push-rod exerting pressure on plug *E*. A close-fitting rubber plug *F* serves as a hydraulic medium against the ends of sleeve *G* and plunger *H*. The diameters of these two parts are proportioned so that their end areas are approximately equal, allowing even distribution of pressure from plug *F*.

On its forward end, sleeve *G* has a chamfer that coincides with the pointed end of clamping plungers *A*. When the sleeve is advanced, all three clamping plungers are forced out radially an equal amount.

The forward flat end of plunger *H* presses against three steel balls *J*. These balls lie in an annular groove formed by an internal chamfer on sleeve *K* and the correspondingly chamfered end of plunger *L*. Relative longitudinal displacement of up to 1.4 times the ball diameter can be had by using a 90-degree included angle in the annular groove. The forward end of sleeve *K* has an external chamfer that operates clamping plungers *B*. Clamping plungers *C* are controlled by the cone on the forward end of plunger *L*.

In practice, a suitable means should be provided for retaining plungers *A*, *B*, and *C* within the mandrel body to prevent their flying out if the lathe is started with no work-piece in place. This may be a spring or a nylon plug extending from the side of the plunger or a limiting pin engaging a slot in the plunger.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts and

LaSalle Special Machine for Rapid Processing of Rear-Axle Housings

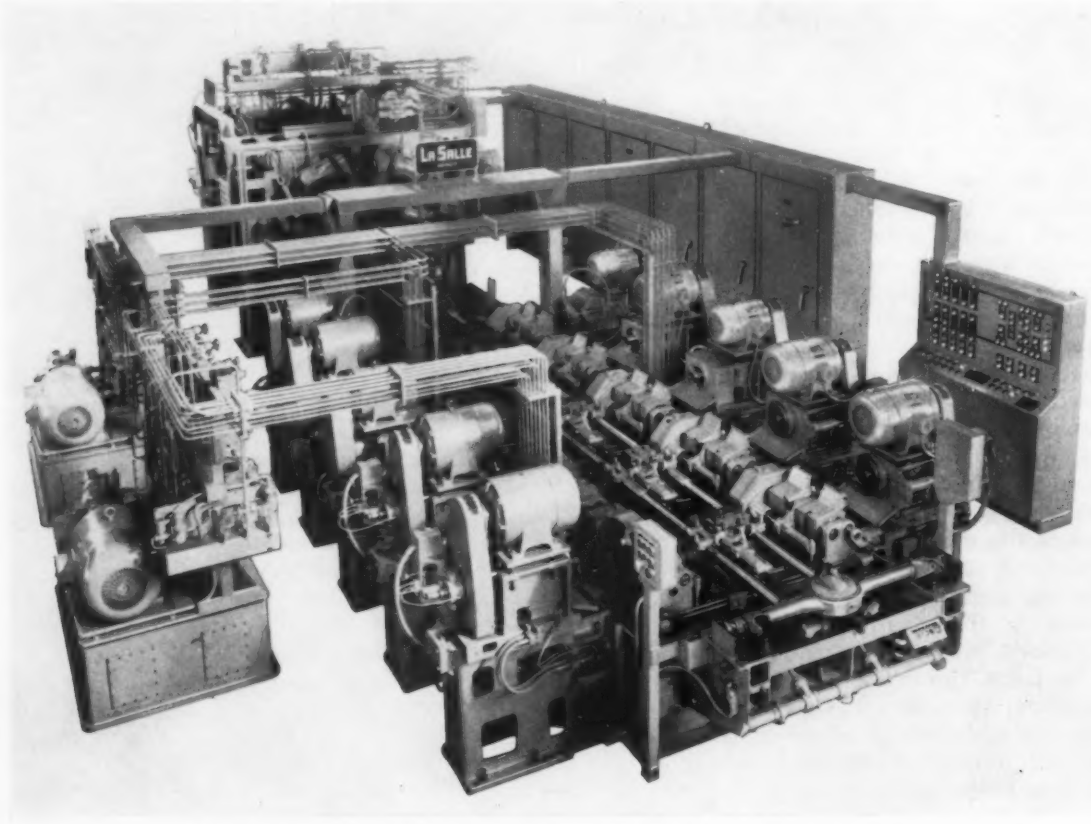
A huge 13-station production machine that performs forty-six operations every 26 seconds on either an air-ride or conventional rear-axle housing has been built by LaSalle Tool, Inc., Detroit, Mich., for a leading automobile manufacturer. This machine features standard LaSalle sectional modular construction that facilitates retooling to suit changes in product design. Provision is made for complete accessibility to all sections and working tools. All spindles are built to accept pre-set tools. The shuttle is of the modified walking-beam type.

The rear-axle housings finished on this machine can be used with either the conventional or the newer air-ride type suspension without further processing. The machine is built to JIC electrical, hydraulic, pneumatic, and lubrication standards throughout. The motion of each unit of the machine is recorded with a mechanical latch-type relay, to guard against double cycling, or faulty cycling during setup.

A new type console was developed to integrate the hydraulic and electrical controls of the machine. Both of these systems are designated to permit following the operations of the machine without using either electrical or hydraulic diagrams.

All of the hydraulic manifolds use O-ring mountings for valves and fittings, to eliminate pipe-thread leakage. A LaSalle filter system is used to filter all of the oil in the hydraulic system. Another feature of the machine is the central coolant and chip system. Individual regulators have been incorporated to control the coolant delivery to each tool used in the machine.

Circle Item 101 on postcard, page 227



Special machine to process rear-axle housings built by La-Salle Tool, Inc.

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

Fosmatic Equipped for Automatic Tool Changing

Completely automatic operation of a jig boring machine made by the Fosdick Machine Tool Co., Cincinnati, Ohio, has been achieved by the Manufacturing Research Department of International Business Machines Corporation, Endicott, N. Y., through the addition of two special mechanisms. One mechanism chooses a boring tool, inserts it, and then removes it. The other mechanism controls the hole depth. The Fosmatic No. 54 jig borer provided with these new controls is similar to the tape-controlled Fosmatic previously announced.

This newly equipped automatic jig borer will perform all operations on a given part without attention from an operator. Machine functions are programmed by numerical control using IBM cards, including choice of thirty or more tools, positioning of holes, selection of spindle speeds and feeds, hole depth, and spindle-head height. As a result of this development, setup time at the machine is virtually eliminated and planning of the program is normally done in the engineering department. Machining cycles are also said to be considerably shorter, costs substantially reduced, and the quality improved.

The completely automatic Fosmatic jig borer with IBM card control, as shown in Fig. 1, is employed at the Endicott, N. Y., plant of the International Business Machines Corporation in the production of side frames for its data-processing equipment. Thirty operations are performed on each part. Total hole-location error in the 16- by 18-inch side frames has never exceeded 0.0004 inch.

The spindle speed and feed of this machine are varied by controlling electromagnetic clutches —sixteen spindle speeds from 30

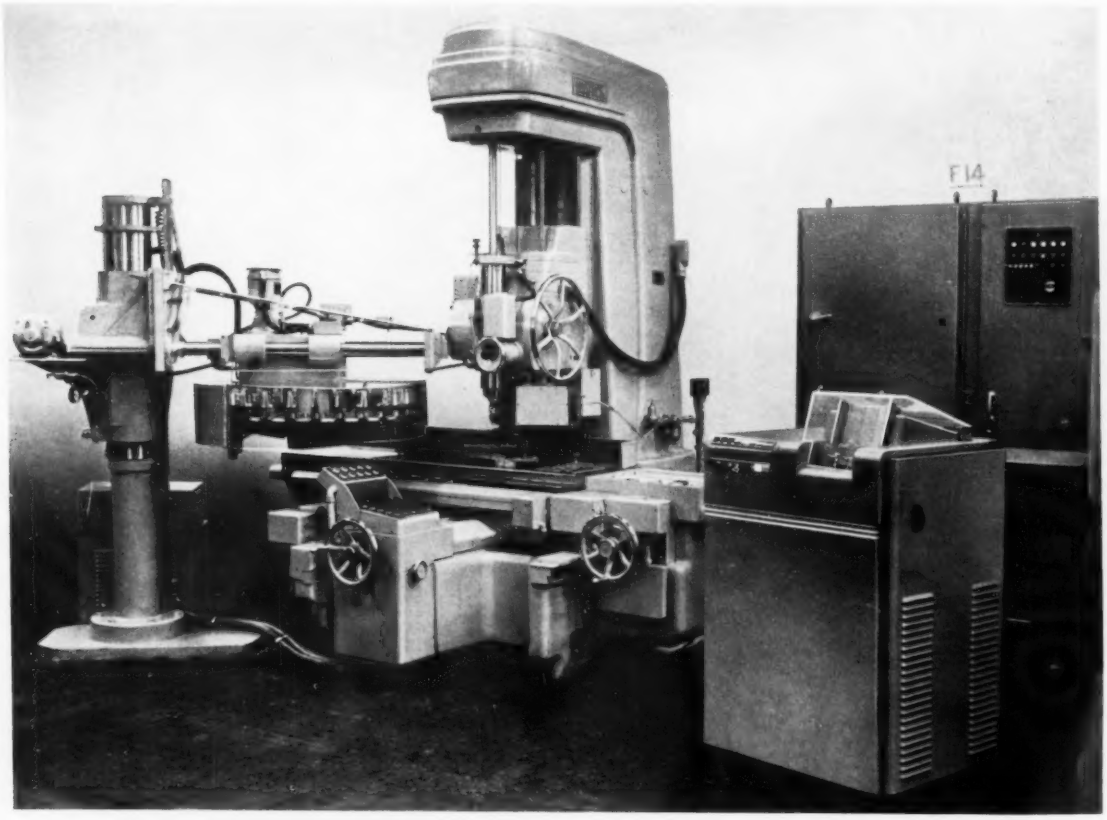


Fig. 1. Completely automatic Fosmatic jig borer controlled by IBM cards

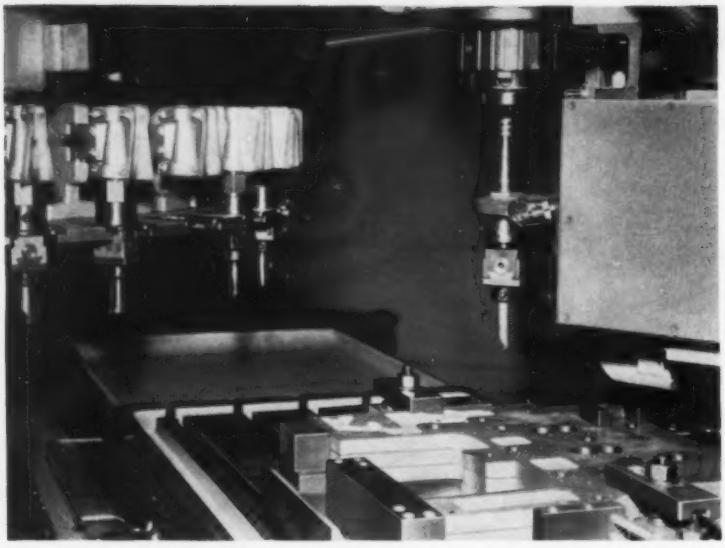


Fig. 2. Automatic tool-changer equipment of machine shown in Fig. 1 which selects the programmed tool from the rack and inserts it in the spindle

to 1800 rpm and eight feed rates from 0.0005 to 0.010 inch per revolution are available. Clutch selection is made through relay contacts so that remote control is practical.

Measurement of table position along X and Y coordinates is achieved by lining up series of end-measuring gages. There are four gages in even tens of inches, ten in inches, ten in tenths of inches, and so on down to 0.0001-inch increments. The gages are selected by motor-driven drum dials and positioned end to end to provide the required measurements. In the IBM setup, data punched in the cards is translated into table position.

Movement of the table stacks the gages and moves them against a limit switch. At this point the table movement is stopped, the lead-screw is relieved by reversing a slight amount, and the table is clamped. Accuracy is held to plus or minus 0.0001 inch. Data for the machine program are punched in IBM cards with all specifications for one hole stored in a single card. Therefore, each part is programmed in a "deck" of cards.

The automatic tool-selection equipment, Fig. 2, is faster than manual operation and can be accomplished simultaneously with other machine functions, such as table positioning. The storage unit is floor-mounted apart from the machine. Thirty tools are carried in a disc which can be indexed to a pre-selected position under card control. This unit slides on horizontal tie-rods so that tools may be positioned under the spindle.

In operation, the tool-holding disc rotates to the position specified in the program. It then moves radially under the spindle where an air-operated wrench closes on the tool-holder. After the disc mechanism is retracted, the spindle feeds down while rotating slowly and engages the thread at the end of the tool-holder shank. At a predetermined locking torque, the wrench opens and the spindle feeds down in accordance with the program. Removing the tool is accomplished by the same steps in reverse sequence.

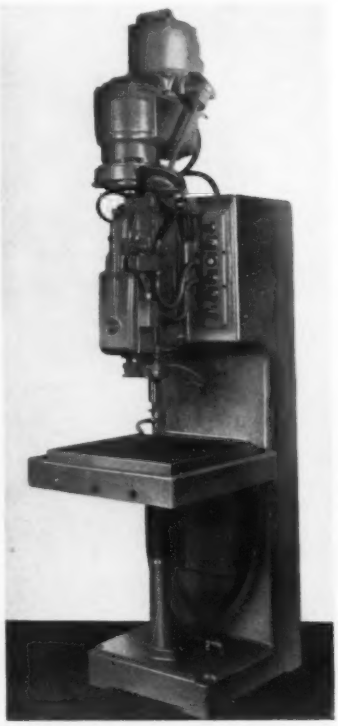
In devising a method to control hole depth automatically, advantage was taken of the fact that a work-piece mounted on a machine is subjected to two general levels of vibration. The first results from the machine motors, gears, etc. The second occurs when a cutting tool enters the work, and this vibration can be recognized by a piezoelectric crystal mounted on the work-holding fixture. After the tool enters the work, measurements are controlled by a shaft digitizer geared to the down-feed spindle drive, pulses being obtained for each 0.001 inch of down feed.

Spindle rapid traverse downward is controlled by a photoelectric unit. As the tool feeds down, it passes through a beam of light. From this point, it continues to traverse a predetermined distance where it shifts into the cutting feed rate. After the tool enters the work, the shaft digitizer takes over control of the hole depth.

Circle Item 102 on postcard, page 227

High-Speed Automatic Cycling Drill Presses

The Seacrest Machine Co., Washington, D. C., has recently announced a new line of high-speed automatic-cycling drill presses. These machines are unique in that spindle speeds, feed range, stroke, feed stroke, and rapid approach are infinitely variable. They are equipped with Morris Air-Oil-Matic drill heads



Seacrest high-speed automatic-cycling drill press

providing complete automatic cycling with fast approach and fast return for drilling or tapping, and positive stop with adjustable time delay for such operations as spot-facing, counterboring, etc. The machines are furnished in single- or multiple-spindle models.

Feeds and speeds are infinitely variable and are easily and quickly adjusted by conveniently located controls. Each spindle has an individual control station by which the type of operation cycle is selected. Simply pushing the start-button causes the drill to automatically go through the selected cycle.

The variable speed drive provides infinitely variable spindle speeds with maximum spindle speed of 8000 rpm available on the standard machines. These machines are available with any one of seventeen different speed ranges and the speeds within the selected range are infinitely variable with a ratio of 7 to 1 maximum to minimum spindle speed. Multiple feeds and rapid approach movements are available through special feed dogs.

Circle Item 103 on postcard, page 227

Fig. 1. Cincinnati Flamatic heating machine

Cincinnati Flamatic and Induction High-Frequency Heating Machines

A new concept in precision selective-flame heating is being introduced by the Process Machinery Division, Cincinnati Milling Machine Co., Cincinnati, Ohio, in a new Flamatic flame-heating machine, Fig. 1. This machine incorporates the building block principle of construction; is of functional, flat bed design; and has a large, flat, open area on which any of a wide variety of work-handling fixtures can be mounted.

The machine shown in Fig. 1 simultaneously spot-hardens the cup and pad sections of automotive rocker arms, six at a time. The heating cycle is automatic, the parts being dropped into the quench tank at completion of cycle. Constant quenching conditions are assured by the large volume of quenching medium with high-capacity heat exchanger and automatic-quench agitation system. A built-in conveyor removes finished parts from the quenching medium.

Fig. 2. High-frequency induction heating machine equipped for hardening ends of automotive push-rods

The high-frequency induction heating machine, Fig. 2, shown performing an interesting hardening operation, is also a new development of the Process Machinery Division of the Cincinnati Milling Machine Co. This machine is tooled up for the simultaneous hardening of both ends of automotive push-rods, an operation that is performed automatically and continuously. Parts are loaded by hand into a magazine type fixture which, in turn, automatically loads them into notches in the periphery of a rotating drum type fixture. As the parts are carried around by the drum, each end is passed through an arc-shaped,

high-frequency heating coil which heats it by induction as it passes along the coil. Parts drop from the drum by gravity into the quench tank directly below, and a conveyor in the tank delivers the finished parts to a receptacle at the right-hand side of the machine. Production of one push-rod each second illustrates the capacity for rapid heating that permits this machine to be located directly in the production line, if desired.

Circle Item 104 on postcard, page 227

Submerged Twin-Arc Welding Machine

A high-production automated submerged twin-arc welding machine that performs controlled welding operations on both sides of extra large parts is now available from the Expert Welding Machine Co., Detroit, Mich. The machine illustrated performs four reinforcement welding operations along the edges of both sides of long, hollow rectangular bulldozer push beams. These beams are 12 feet in length and have a cross section of 8 by 8 inches. This machine is designed to accommodate a wide variety of large production parts and has a welding rate of 80 inches per minute.

The large heavy beams to be welded are loaded on the bed of the machine by a crane or other loading device. An air-operated, toggle type mechanism located in the bed of the machine then lifts and squares the part. Two air-operated centering and clamping fixtures located on each end of the bed then center and clamp the part in position. Next, two twin-arc welding heads, which are mounted on a traveling beam, apply two reinforcement welds along each side of the beam. During the welding operation the correct position of the torch, relative to the part, is maintained by a cam follower that rides along the side contour of the part.

After the welding operation has been completed on one side of the push beam, the toggle type squaring mechanism retracts and the part is automatically turned over by the centering and clamping fixtures. One fixture is geared to an air-powered rack. The rack rotates the fixture 180 degrees to achieve the turn-over operation. After the turn-over operation has been accomplished, similar welding operations are performed on the other side of the part.

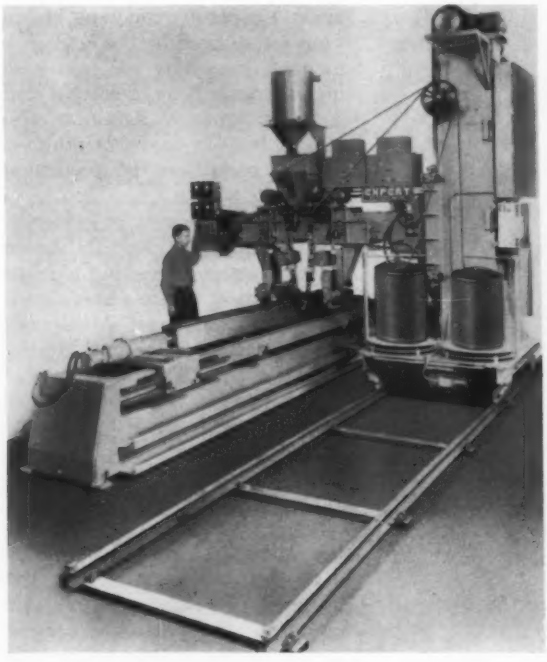
The automated welding machine occupies a floor space about 15 by 15 feet and is 13 feet high. The carriage is driven by a potentiometer-controlled direct-current motor.

Circle Item 105 on postcard, page 227

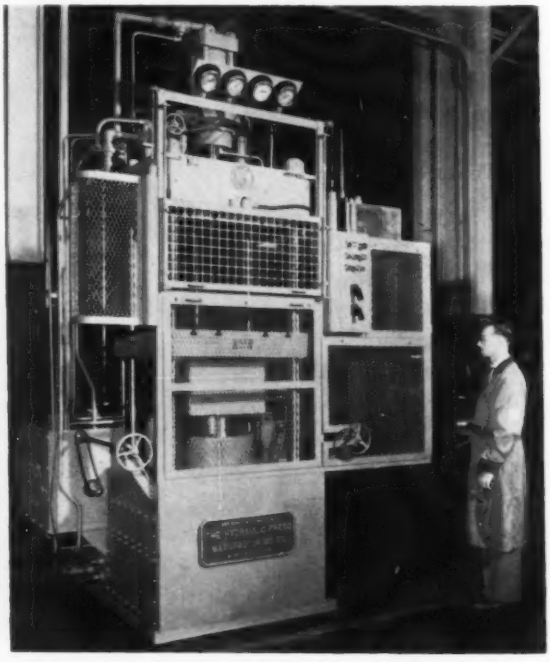
Semi-Automatic Plastics Transfer Molding Press

An upward acting, semi-automatic plastics transfer molding press, equipped with a top-mounted transfer cylinder, has been especially designed for a large manufacturer of telephone equipment by the Hydraulic Press Mfg. Co., A Division of Koehring Co., Mount Gilead, Ohio. This press, one of several built for the same company, is completely automatic. It is furnished with automatic loading, feeding, and preheating equipment.

The 12-inch clamp stroke is adjustable at any point in the stroke.



Expert submerged twin-arc welding machine



H-P-M semi-automatic plastics transfer molding press

Pressing surfaces for both upper grid and platen are 36 by 16 inches. Daylight capacity between platen and head is 30 inches. A 10-ton hydraulic ejector system, built under the moving platen, ejects finished parts.

The transfer cylinder, located on the press head, has a maximum force of 25 tons which is adjustable to a minimum of 8 tons. The stroke of the transfer ram is 9 inches. The press is powered by one 15-hp electric motor and employs variable displacement hydraulic pumps for accurate control of speeds and pressures.

Circle Item 106 on postcard, page 227

Hammond Morrisflex Semi-Automatic Gear-Deburring Machine

A semi-automatic gear-deburring machine, designated the Morrisflex Model MA-660, is being introduced by Hammond Machinery Builders, Inc., Kalamazoo, Mich. This machine is designed for use with a polishing lathe and wire brushes to deburr and radius-finish gears, splines, and serrated parts. It eliminates hand deburring and makes it possible for even unskilled workers to produce uniform finishes.

Rotation of the work, constant pressure against the brushes, and dwell time are all controlled by the machine. The work-head, located at the top of the traversing arm, rotates at 80 rpm and can be adjusted vertically and horizontally. A lead-screw, operated by a handwheel, provides lateral adjustment of the traversing arm to center the work between the brushes.

A double-acting air-pressure system moves the traversing arm from the loading position to the brushes and presents the work to the brushes at the correct pressure and dwell time. The pre-set timer switch then shuts off the machine and the air system withdraws the work from the brushes to complete the cycle.

The pre-set timer switch is the heart of the automatic cycle. Once the correct dwell time is established and set on the dial switch, the operator is required only to load, unload, and push the switch button for automatic processing of the work. The machine is available for use on the right- or left-hand side of a lathe.

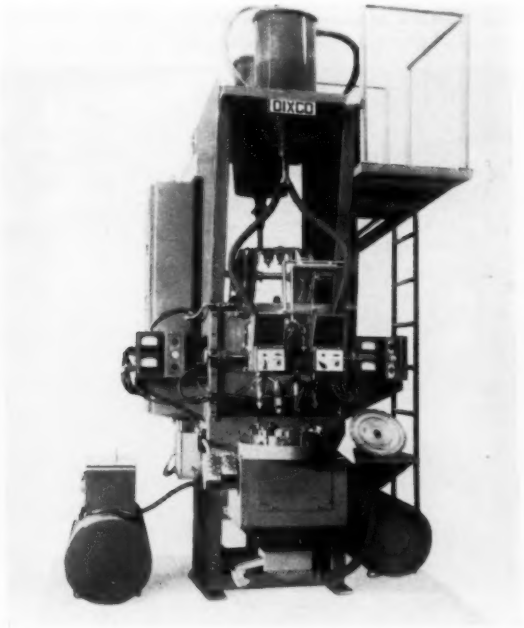
Circle Item 107 on postcard, page 227

Dixco Automatic Submerged-Arc Welding Machine

A special submerged-arc welder has been designed and built by Dix Engineering Co., Inc., Detroit, Mich., to perform welding operations on automatic transmissions that previously required the use of two machines. Except for loading and unloading, this machine is fully automatic. It performs welding operations on two models of flywheel ring-gear assemblies. In processing the first model, the assembly of a ring gear, pre-pressed to a flywheel stamping, is loaded into the holding and locating fixture. Nineteen seconds after the run, buttons are pushed and ten equally spaced submerged-arc spot welds are completed, the part being indexed and welded automatically.

When production of the second model is required, a selector switch on the control board is

Morrisflex semi-automatic deburring machine introduced by Hammond Machinery Builders, Inc.



Automatic submerged-arc welding machine built by the Dix Engineering Co., Inc.

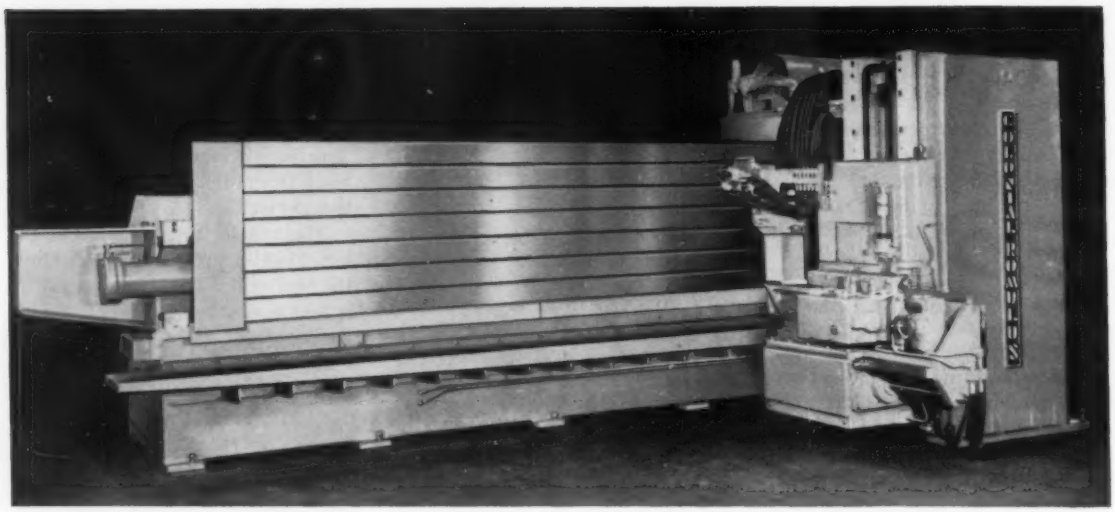


Fig. 1. Machine developed to make tracer-controlled contour- and profile-milling operations easier in a wide range of metals built by the Colonial-Romulus Division of the Colonial Broach & Machine Co.

closed, causing the machine to join the members of this assembly with ten unequally spaced welds. This dual-purpose welder will process 100 assemblies per hour of either type at 80 per cent efficiency.

Materials used in the welding operation are bare welding wire and a granular flux which protects the weld puddle against oxidation. Automatic feeding of the wire and dumping of the flux are additional features of the machine.

Circle Item 108 on postcard, page 227

Colonial-Romulus Hydraulically Driven Tracer-Controlled Contour- and Profile-Milling Machine

Hydraulically driven sculpturing machines, designed for easier and faster tracer-controlled contour- and profile-milling operations, are now available from the Colonial-Romulus Division of the Colonial Broach & Machine Co., Detroit, Mich. The sculpturing machine line, in two models, complements the division's present lines of Dupli-Mill and Hydro-Cycle tracer-controlled mills.

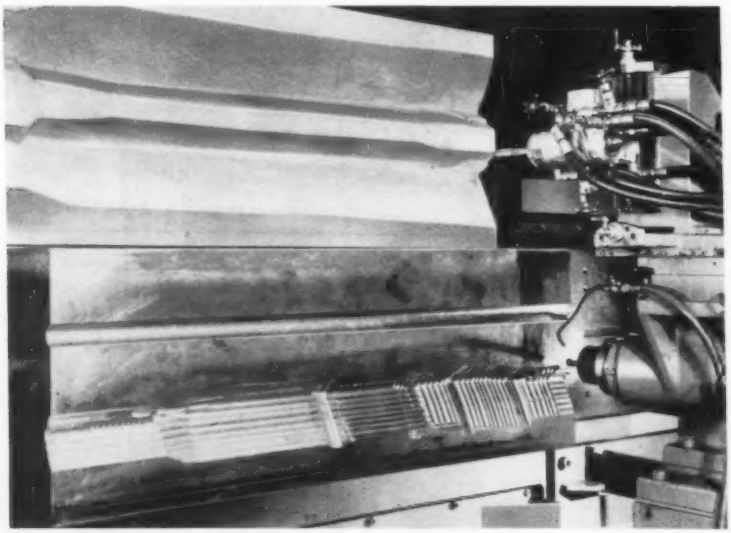


Fig. 2. Colonial-Romulus new tracer-controlled sculpture machine of 24-ton, 144-inch stroke capacity equipped to rough cut a forging die from a plaster master. Finish-machining is done in the same setup.

Drive from a variable-speed hydraulic motor through reduction gears provides infinitely variable spindle speeds from 36 to 1900 rpm. A heavy main column contains the vertical and in-and-out feed movement. Cutter, stylus, and controls are positioned for easy operator use and vision. The vertical slide, comprising a heavy, extremely rigid component, is designed for high metal-removal capacity. To obtain the utmost in sensitivity, the counterbalanced slide is arranged to move in hardened and ground ways. Both the work and the template mounting are on the vertical face of the ram. The machine base is a rigid weldment reinforced with heavy internal ribbing to provide freedom from vibration and distortion.

The sculpture machines will handle a wide range of metals (including the latest high-temperature, high-strength alloys) with consistent accuracy. Jobs as long as an aircraft wing spar or as compact as small forming dies can be handled. Small-size work-pieces can be machined side by side. The machines permit true three-dimensional duplication at maximum speeds and feeds for the material being machined. These sculpturing machines are now available in two sizes: a 120-inch stroke

model and a 144-inch stroke model. Both models have a cross travel of 24 inches. Special sizes and capacities can also be supplied. Depth control is optional equipment on all models.

The milling spindle is equipped with specially developed preloaded and anti-friction bearings to retain the spindle in accurate alignment at high speed. The same bearings also take the high cutting force of low-speed operation. The spindle can be infinitely moved in-and-out or up-and-down within the range of from 1/2 to 40 inches per minute. Horizontal movement of the work and template is also infinitely variable within the same range. Tracer controls are available in any combination: (1) three-dimensional; (2) 360-degree with adjustable depth control; and (3) tracer-controlled with longitudinal power feed. Micrometer adjustments facilitate setup.

Circle Item 109 on postcard, page 227

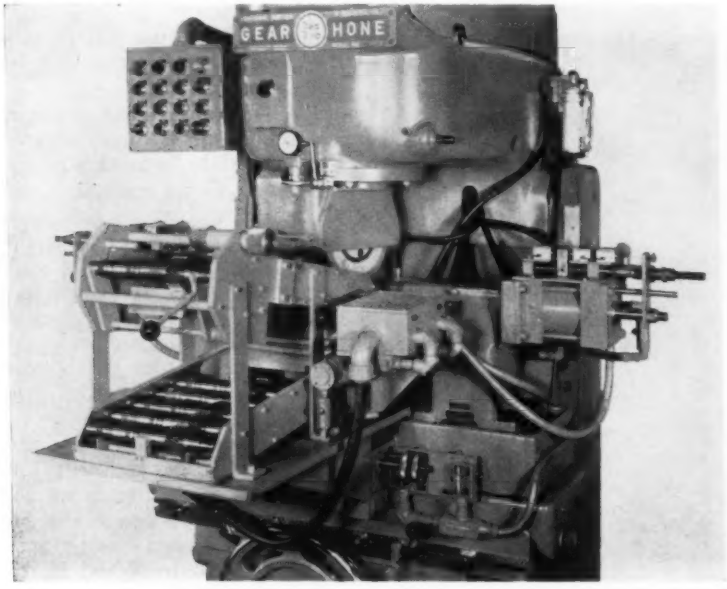
Automatic Loader for Honing and Shaving Machines Planned to Handle Long-Shaft Unsymmetrical Gears

A rocker type Red Ring automatic loader for handling long-shaft, unsymmetrical gears on both gear-tooth honing machines and rotary-gear shaving machines is announced by the National Broach & Machine Co., Detroit, Mich. The loader has a built-in gaging device, magazine feed, air-powered rocker type loading mechanism, and a discharge chute that feeds finish-honed parts to the unloading position.

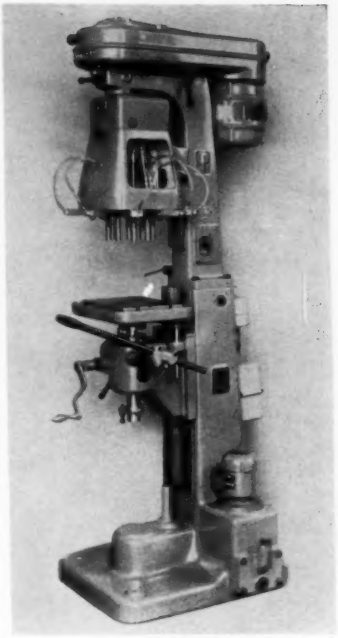
A specially designed assembly of lever type grip fingers in both input magazine and discharge chute keeps the gears from touching each other and avoids the cocking of parts that can result from the effect of the greater weight of one end of an unsymmetrical, long-shaft gear.

The rocker type unloader mechanism is a simplified design that requires minimum maintenance and is practically unaffected by chip conditions. Operation of the loader is entirely automatic when used in conjunction with standard gear-tooth honing machines or rotary-gear shaving machines equipped with suitable controls and air-powered headstocks and tailstocks. The operator merely keeps the input magazine full of gears and removes finished gears from the exit chute.

Circle Item 110 on postcard, page 227



Red Ring automatic loader for honing and shaving machines.



Drilling and tapping machine introduced by Aaron Machinery Co., Inc.

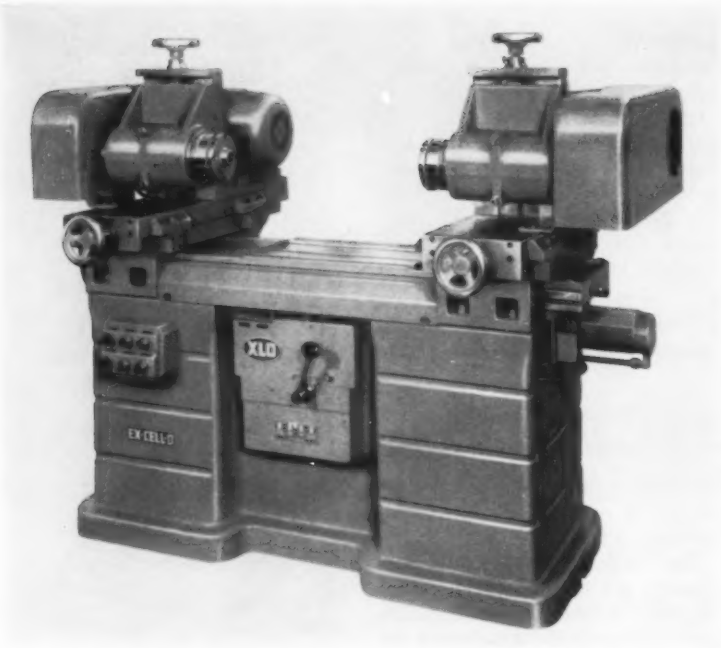
Multi-Spindle Drilling and Tapping Machine

The Aaron Machinery Co., Inc., New York City, has introduced the Imperial Model MU-8 drilling and tapping machine. The spindles can be fixed in any position—either in circles, in straight lines, or irregularly—and they can be rotated at different speeds. By applying gears, two different speed rotations can be attained simultaneously.

The drilling or tapping operation is performed by raising the table, which is operated by a lever. The drilling depth can be adjusted at will by a special device with a micrometric screw, fitted on the table bracket. The table is provided with an automatic electric cut-out, so that the machine will operate only when the table is raised.

Tapping is accomplished by lifting the table until the taps have contacted the work. The component in which the taps are introduced is raised until it reaches the feeler; then reverse rotation of the spindles, as well as the ejection of the tapped piece, occurs immediately.

Circle Item 111 on postcard, page 227



Universal precision boring machine brought out by the Ex-Cell-O Corporation

Ex-Cell-O Precision Boring Machine

A Style 1212-B precision boring machine, designed for universal use, is announced by the Ex-Cell-O Corporation, Detroit, Mich. This machine was built for a large radio and electronics manufacturer, and is equally well adapted for production, semi-production or tool-room operations. It is equipped with special vertical and horizontal spindle slides and can handle an extremely wide variety of work-pieces. The vertical spindle adjustment is 2 inches between 9 and 11 inches from the spindle center line to the table. This combined with a 4-inch horizontal adjustment permits an infinite number of boring-tool positions.

The bridges can be spaced relatively wide apart for medium-size work-pieces, or close together for smaller work. Both ends of the machine may be operated in the same setup, or operated individually in separate setups. A standard long-stroke hydraulic cylinder is furnished that gives 6 inches of extra table travel, providing a total travel of 18 inches. Two-speed motors drive the spindle by belts through a range of single-sheave or multiple-step pulleys, giving an extensive range of spindle speeds.

Circle Item 112 on postcard, page 227

Template hole-locating and drilling machine designed for rapid, high-precision operation announced by Wiedemann Machine Co.

High-Speed Template Hole-Locating and Drilling Machine

Holes are rapidly located and drilled in templates to within accuracy limits of 0.002 inch with a new machine just announced by the Hicks Coordinator Division, Wiedemann Machine Co., Philadelphia, Pa. This compact machine can also be used to produce drill jigs, simple fixtures, and other precision work in flat sheet metal or plate.

It is also particularly suited for the production of templates up to 36 by 42 inches for Wiedemann turret punch presses and other equipment. Holes from 1/16 to 3/8 inch in diameter are accurately located and drilled in a fraction of the time normally required by other methods.

In operation, material is placed against an end-stop and secured to a cross-slide by work-positioning clamps. Using a simple X and Y coordinate chart for hole locations, the operator makes the dimension settings quickly with two optical scanners in conjunction with fixed scales. As soon as the location settings are made, the hole is drilled from the bottom through a carbide precision drill guide bushing.

Any number of holes of uniform size can be located and drilled in rapid sequence. There is no accumulative error since all dimensions are measured from a zero reference point to X and Y coordinates.

Circle Item 113 on postcard, page 227

Gleason Quenching Press

A completely automatic loader and unloader for the Gleason No. 16 and No. 26 quenching presses is now available from the Gleason Works, Rochester, N. Y. The load and unload mechanism is cam controlled, and a Geneva plate indexes the arms of the unit from the load to unload position. The arms are at 90 degrees to each other; one arm completes the loading action, and the other simultaneously completes the unloading. The unit is attached to the front of the quenching press and is timed to operate in conjunction with the quenching cycle.

The sequence of operations of the load and unload mechanism follows. With the lower die of the quenching press in the forward position, the part to be quenched is delivered from the furnace under the load arm of the unit. The arms of the load and unload mechanism are then lowered and the adjustable jaws of the load arm close on the part. Still holding the part, the arms are raised and rotated 90 degrees and lowered over the die, releasing the part in the proper position. Next, the lower die of the quenching press swings in to the quenching position, and the arms rotate 90 degrees back to the original position. At the end of the pre-set quenching cycle, the lower die of the quenching press swings out to the unload position. As subsequent parts are received from the furnace, the same sequence occurs. Now, however, both arms are utilized as the quenched part is ready for removal. Both arms are then lowered and the adjustable jaws simultaneously clamp the parts. Next the arms are raised and rotated 90 degrees and lowered and the jaws opened, releasing the quenched part in the tote basket or conveyor. The other arm releases the part to be quenched on the die.

This new load and unload mechanism makes it possible to speed production and reduce labor requirements in the operation of the No. 16 and No. 26 quenching presses. In addition, this unit assures positive control of quality, as the time element from the fur-

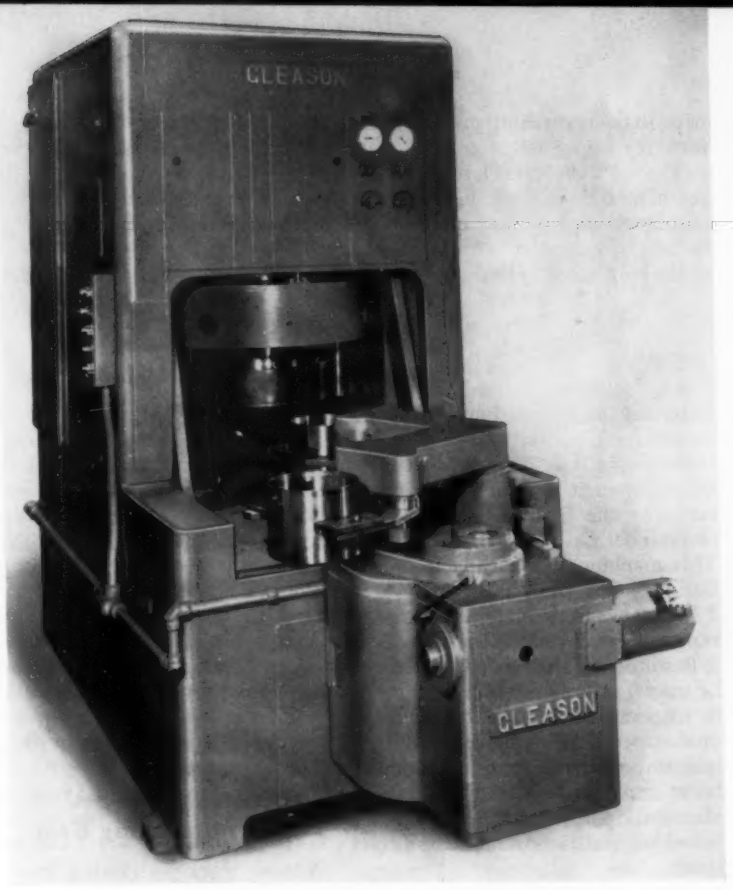
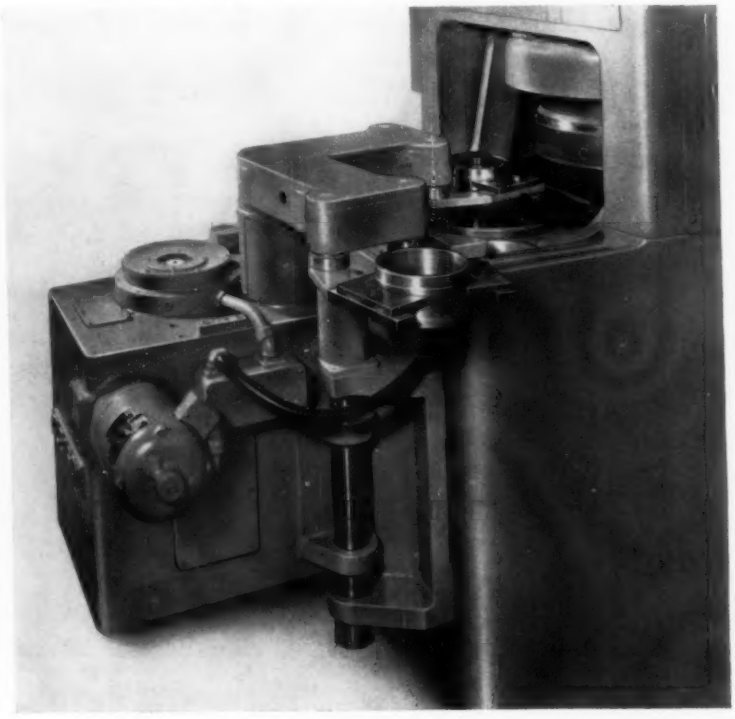


Fig. 1. Gleason No. 26 quenching press equipped with automatic loader for quenching outer bearing race

Fig. 2. Close-up view of automatic unloader unit on Gleason No. 16 quenching press, equipped for quenching inner bearing race



nace to the quenching press is uniform for each part.

The Gleason quenching presses accommodate round, flat, or irregular-shaped parts up to 25 inches in diameter, and provide quenching under close automatic control at all stages of the quenching cycle. The parts are held between precision dies during the quenching cycle, and they are correctly hardened with a minimum of distortion.

Circle Item 114 on postcard, page 227

LeBlond-Carlstedt Rapid Borer

A LeBlond-Carlstedt rapid borer that is said to bore, trepan, or counterbore long holes 3 to 8 times faster than conventional D-bit equipment is being manufactured by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. This machine has a capacity for boring holes from 5/16 inch to 4 1/4 inches in diameter in a large range of work sizes. In general, it is suited to work that is, or can be made, symmetrical for balance in rotation—round, square, octagonal, tapered, or stepped. In addition to parts with long holes, the borer will successfully handle identical parts which can be bored as one piece and then cut apart.

The rapid borer was developed expressly to accommodate revolutionary new tooling which cuts at very high speed with excellent accuracy and finish. Cutting oil is forced between the boring-bar and hole wall, forming a continuous bearing. It flushes back through a hole in the boring head and bar, carrying away the chips as it goes. Chip form is controlled both by tool angles and the proper combination of feed and speed; thus tool faces are kept clean and the chip passage clear. Cutter design produces balanced cutting pressures, thereby controlling concentricity. The machine is available in three sizes, No. 15, No. 30 and No. 60.

Circle Item 115 on postcard, page 227

Federal "Sure-Set" Work-Positioning Gage

A new work-positioning gage, called the "Sure-Set," has been announced by Federal Products Corporation, Providence, R. I. This gage makes use of a novel idea in the positioning of the swivel table on universal type grinders, which enables the operator to produce work of the desired straightness (cylindrical or tapered) without using charts, correction tables, mathematics, or repeated trial-and-error grinding.

The gage can be used with any make universal grinder and on a swivel table of any length. It incorporates two completely enclosed electronic gage heads which are located on the grinder at the ends of the table and are connected with a special amplifier through a selector switch.

Circle Item 116 on postcard, page 227

Delta Lathes with Flame-Hardened Ways

The Delta Power Tool Division, Rockwell Manufacturing Co., Pittsburgh, Pa., has announced that Delta 11-inch metalworking lathes in both the four-foot and five-foot bed models are now available with flame-hardened bedways. The new bedways—available at an extra cost—are flame-hardened, then precision-ground with a diamond-dressed wheel on precision way-grinding equipment. They are specially designed and recommended for use in machining materials that produce hardened chips or dust with abrasive qualities and in school

LeBlond-Carlstedt rapid borer built by the R. K. LeBlond Machine Tool Co.

Delta lathe with hardened and ground ways

Niagara ring and circle shear with power down feed

shops and other shops in which standard bedways may be chipped, dented or scored by dropping of tools and other careless or inexperienced handling.

Circle Item 117 on postcard, page 227

Ring and Circle Shear with Finger-Tip Control

Finger-tip control and power down feed facilitate the operation of a ring and circle shear designated Model 33 RC, introduced by the Niagara Machine & Tool Works, Buffalo, N. Y. This machine has been developed to make quick, easy work of cutting commercially perfect circles, circular holes and rings in mild steel up to 1/4 inch thick. Push-buttons simplify cutter and down feed operation, eliminating difficult hand feeding of cutters into the plate. The power down feed is designed to raise and lower the upper cutter easily and quickly. It also drives the upper cutter down into the material automatically as the cut progresses. Cutter descent can be stopped at any depth, and overtravel of the cutter in either direction is prevented by limit switches. This arrangement permits cutting to be started at any point within the blank.

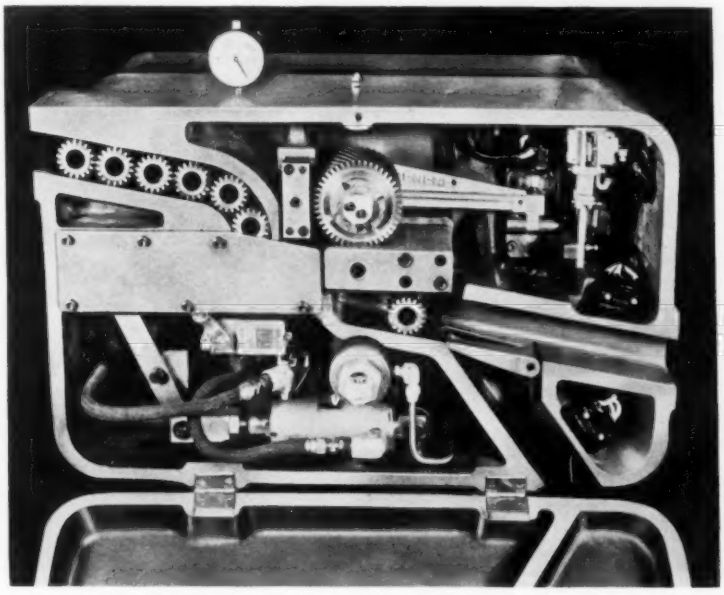
Built-in motor controls are housed in the sturdy, steel-plate frame, with nothing protruding to mar the clean-cut styling. Other features include a self-compensating circle arm which floats on guided ways to maintain the true center automatically, despite varying thicknesses and types of materials; an adjusting crank to enable quick positioning of the circle arm for cutting circles of various diameters; an adjusting swing gage; and high-carbon, high-chromium cutters.

Circle Item 118 on postcard, page 227

Automatic Gear-Checking Equipment

An automatic gear-monitoring unit designed for 100 per cent concentricity inspection of spur or helical gears is the latest addition to the gear-classifier line developed and built by Michigan Tool Co., Detroit, Mich. This unit uses conjugate rolling action in two directions of rotation with a master gear in mesh with a part to determine and monitor the amount of eccentricity in the part. After being checked, parts within predetermined tolerances are automatically passed for the next operation, and parts that are eccentric are shunted from the system.

Like all of Michigan's gear checkers, this unit is designed for integration into automated pro-



Automatic gear-monitoring unit that inspects spur or helical gears for concentricity made by Michigan Tool Co.

duction lines, particularly those lines using Gear-O-Mation systems. One central panel can electrically operate allied automation units. Total time for the full checking cycle is 6 seconds. Accuracy adjustment is infinitely sensitive to eccentricity errors. The unit, initially designed for short planetary gears of automatic transmissions, is available in a range of sizes to suit not only automotive gears but other production applications of larger and smaller gears.

Allied units consisting of a blow-off unit, three-way classifier, and parts elevator precede the concentricity checker. Parts enter the unit by gravity and roll into a shuttle slide. The shuttle advances, meshing the part with a master gear and tripping a limit switch that actuates a push-type diaphragm arbor. The arbor enters and adapts itself to the hole size of the part and positions the part under and in mesh with the master gear.

The part is first rotated in mesh with the master gear in a clockwise direction. The pivot arm of the master gear raises a slide assembly to the high limit of eccentricity in which position the slide locks, and the pivot arm makes contact with a micro switch. The amount of allowable eccentricity is variable by merely adjusting a stop-screw and micro switch.

In the second stage of the check the part is rotated counterclockwise. If a predetermined amount of eccentricity or more is present, the pivot arm of the master gear drops, breaking contact with the micro switch and allowing the reject chute to open. If contact with the micro switch is not broken, the gear is accepted within predetermined limits of micro switch setting. An indicator gage, mounted at the top of the unit, indicates any eccentricity of the part.

Circle Item 119 on postcard, page 227

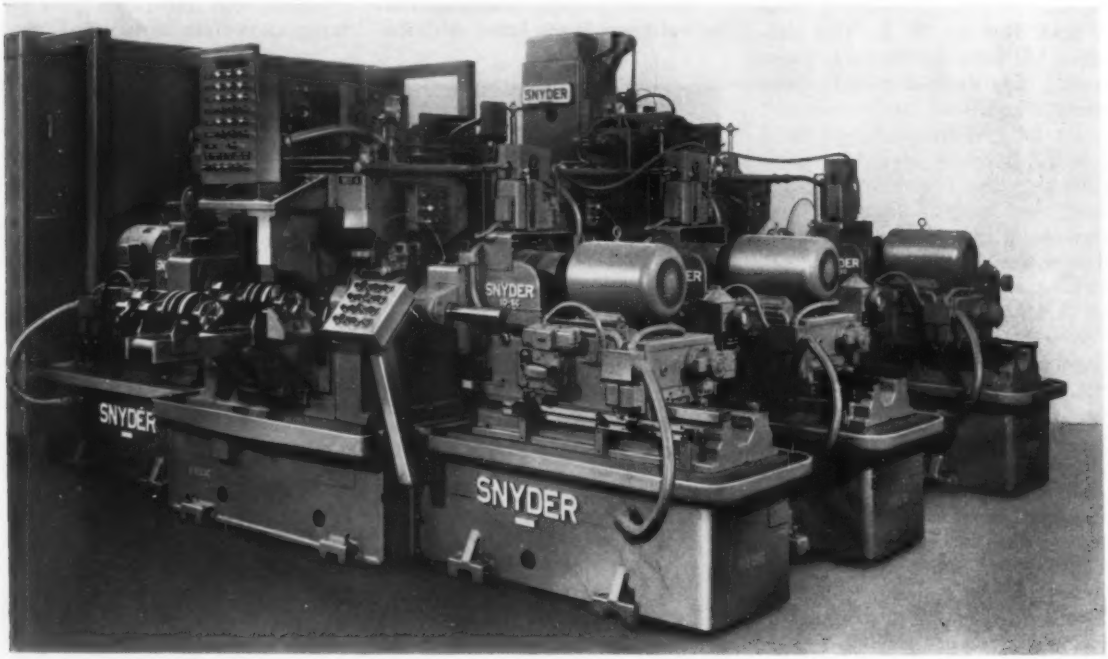
Snyder Transfer Machine Equipped to Process and Inspect Engine Crankshafts

A 10-station segmented special transfer machine that drills, spot-faces, reams, taps, and mills a keyway in automotive engine crankshafts at a net production rate of sixty-four pieces per hour is announced by Snyder Tool & Engineering Co., Detroit, Mich. Tapped holes in the parts are blown out in process and inspected automatically by probe-type gaging fingers to check for through-drilling. The tapped holes are also blown out automatically after tapping.

The machine is made up of three segmented machining units connected by a transfer mechanism. This design provides for maximum tooling accessibility as well as simplifying problems of alteration for design changes.

The crankshafts are loaded into the machine at the first station and transferred to the second station where four holes are drilled in a flange on one end of the crankshaft and one hole is drilled in the other end. Four more holes are then drilled in the flange at the third station and a spot-facing operation is performed at the other end of the crankshaft.

A flange center hole is partially drilled to depth, four flange holes are chamfered, and the hole in the



Snyder special segmented transfer machine that drills, spot-faces, reams, taps, mills, and inspects both ends of engine crankshafts

opposite end is blown out and probe-checked in the fifth station. The flange center hole is drilled to depth, four other holes are chamfered and the probed hole is tapped in the sixth station.

In station nine, an angular seat is formed in the flange and the tapped holes in the other end of the part are blown out. The eight flange holes and the center flange hole are reamed in the tenth station, while a Woodruff keyway is milled in the opposite end of the crankshaft.

Machining operations are performed by Snyder standard hydraulic-powered machining units having hardened and ground ways. Four standard self-contained units and two standard way type units are utilized in the machine.

Circle Item 120 on postcard, page 227

Screw-Slotting Machine

Roy Machinery & Sales, Inc., Farmington, Conn., has announced a screw-slotting machine that will handle screw blanks in nominal sizes from No. 2 to 5/16 inch, in lengths up to 2 1/2 inches. A complete changeover from one screw size to another can be made in approximately fifteen minutes. The machine has a new variable-speed rotary hopper designed for efficient, trouble-free feeding. The hopper is enclosed with spill-proof guards to insure against loss of blanks.

Deburring costs are said to be cut in half through the use of a new rotating mechanism which employs replaceable high-speed steel inserts. A separate cooling system with an independent motorized pump is incorporated in the machine.

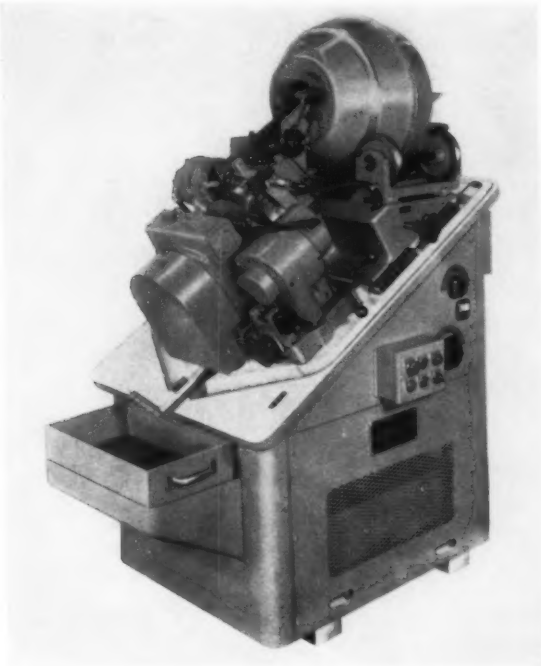
Circle Item 121 on postcard, page 227

Seneca Falls Precision Boring Machine

The Seneca Falls Machine Co., Seneca Falls, N. Y., has added a precision boring machine to its line of production equipment. This new Model NP has been designed to meet the requirements for a top quality, reasonably priced, mechanically operated machine. It is available with either one or more precision spindles mounted independently on a fixed bridge. The spindles may be driven by separate precision balanced motors when different spindle speeds are required, or by a single motor with tandem drive. All boring spindles have super precision preloaded ball bearings and are driven by vee-belts.

Three different types of spindles are available: a low-speed spindle for speeds up to 2500 rpm, a medium-speed spindle for speeds up to 5000 rpm, and a high-speed spindle for speeds up to 10,000 rpm. The design of the headstock bridge permits the installation of other makes of standardized boring heads when such an arrangement favors a reduction in maintenance costs.

The table or platen is mounted on vee and flat ways with extremely long bearings which keep the ways entirely covered at all times, eliminating the possibility of damage through dirt and chips. Longitudinal movements are obtained by a drum cam which assures a positive feed and an exceptionally fine work finish. The machine is also equipped with the



Screw-slotting machine recently announced by Roy Machinery & Sales, Inc.

Precision production boring machine announced by Seneca Falls Machine Co.

Seneca Falls patented Quick Changeover Mechanism which permits variations in the length of carriage stroke, rapid traverse, and feed cycle without changing or purchasing additional cams. This mechanism reduces average changeover time to less than thirty minutes.

Parts can be rotated in fixtures on the boring spindles with the tools mounted on the table, or if it is impossible to rotate the part, it can be held in a fixture on the table and the tools rotated. Standardized cross-slides, both hand and mechanically power-operated, are available. Precision can be held well within the tolerance requirements of the automotive, aircraft, and instrument industries.

The swing-over table is 16 inches, longitudinal table stroke 5 inches, and width of headstock bridge 19 1/2 inches.

The table is 9 5/8 by 19 inches, has a rapid traverse of 370 inches per minute and boring feeds of 0.0005 to 0.054 inch per minute. Each spindle is driven by a 3-hp motor.

The front cross-slide has a cross travel of 1 1/4 inches, cross adjustment of 1 inch, and width of 7 inches. The machine requires a floor space approximately 35 by 49 inches, and with average tooling, has a shipping weight of 4000 pounds.

Circle Item 122 on postcard, page 227

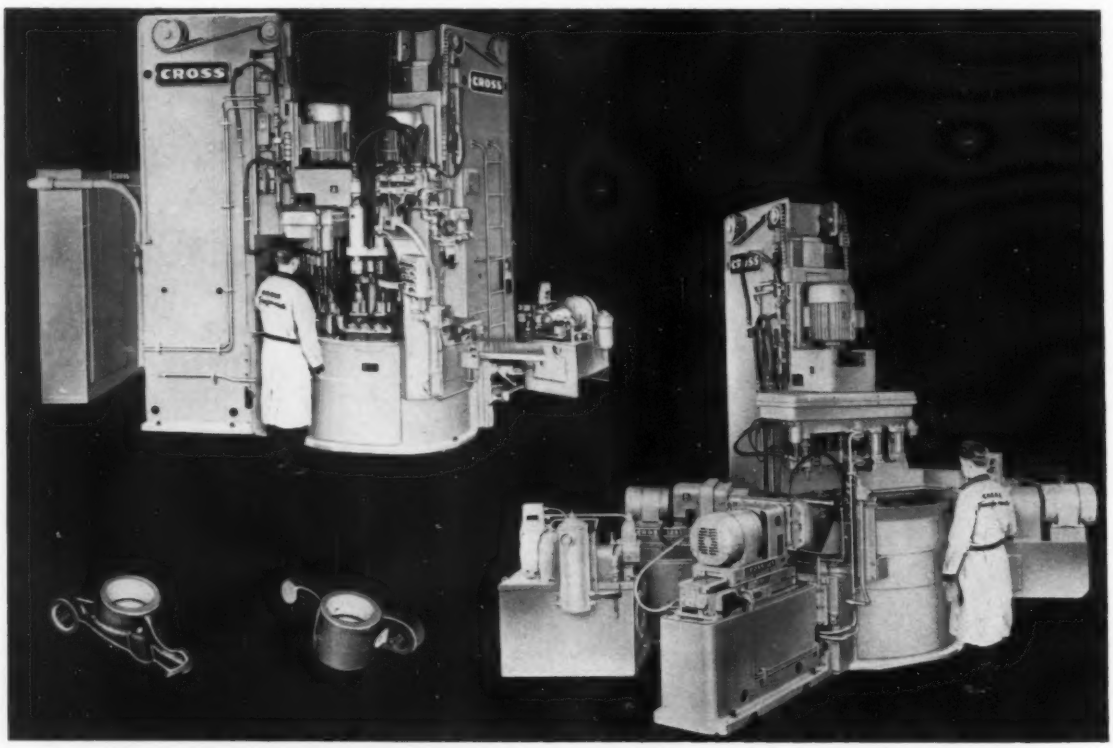
Dial Type Machines for Processing Valve Rocker Arms

Two new dial type machines designed to process automobile-valve rocker arms at a production rate of 800 per hour are announced by the Cross Co., Detroit, Mich. One machine drills and reams the rocker-shaft hole, forms the oil-groove and drills one oil-hole. The other machine drills, chamfers, and taps the adjusting-screw hole; and drills, counterdrills, and spot-faces a second oil-hole. Both machines have six stations.

Because of the critical finish required in the rocker-shaft hole, provisions are made to facilitate changing the spindle speed of the tool for this hole and for the possible future addition of bearingizing. Push-button-controlled power wrenches operate the fixture clamps. New and simpler in design, the power wrenches operate faster, more positively, and are easier to maintain. A separate unloading station is provided, so that automatic unloading can be employed. Manifolds for oil-fog lubrication and coolant are fabricated into the machine bases.

Design of the two machines incorporates complete interchangeability of all standard and special parts for easy maintenance and Cross "building-block" construction which provides flexibility for changes in the design of the rocker arms. Other features include construction to JIC standards, hardened and ground ways, hydraulic feed and rapid traverse for drilling and reaming, individual lead-screw feed for tapping, automatic lubrication, and pre-set tooling throughout the two special machines.

Circle Item 123 on postcard, page 227



Dial type machines for processing valve rocker arms announced by the Cross Co.

Portable Ultrasonic Cleaner

A one-gallon portable ultrasonic cleaning unit is being manufactured for a great variety of industrial and laboratory uses by Hermes Sonic, New York City. This unit is designed to do a quick, thorough job on hard-to-clean objects and intricately assembled parts. Powerful sound waves, beyond the range of human hearing, are propelled into the cleaning solution to create an effective scrubbing action even on minute, hard-to-reach areas. This same principle has been used in the watch-cleaning field, where units made by this manufacturer have been in use for some time. Even the most delicate parts can be thoroughly cleaned with absolute safety by this ultrasonic cleaner.

In addition to cleaning, the new unit is highly effective for degreasing, decontamination, removal of excess flux, mixing, and emulsifying. The unit consists of a generator that features a built-in timer, tuning knob, and visual control for producing an output of 50 watts average with a peak of 200 watts; a stainless-steel one-gallon tank equipped with three transducers capable of handling production jobs on a continuous basis.

Hermes Sonic portable ultrasonic cleaner

Circle Item 124 on postcard, page 227

Sheffield X-Ray Gage for Checking Thinness of Fast-Moving Foil

Low-intensity X-rays in split-second pulses scan film and foil speeding by at 100 feet per second, and measure strips 0.0002 inch thick to millionths of an inch accuracy in a new type gage developed by the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. By using pulses instead of continuous radiation, this new "Measuray" gage pinpoints changes of thickness even at extremely high speeds of strip production. At 600 pulses per second it provides an individual thickness reading every third of an inch on foil fed at the rate of 1000 feet per minute.

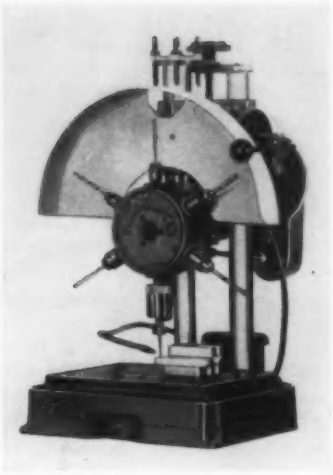
This gage is designed to measure instantly and accurately a wide range of materials produced in continuous strips. These include plastic film, foils made of steel, aluminum, copper or brass, as well as sheet and bar stock. The gage will take up to 36,000 individual readings per minute on strips of these materials.

The X-ray pulse passes through a strip that comes between the emitter and receiver of the scanning unit. The receiver detects and amplifies the X-ray energy that manages to get through. A slight increase in thickness means less energy received. Detecting and amplifying this difference, the new gage then registers it on an indicator in millionths of an inch.

Negligible wiggle, or random movement, of the indicator needle makes the new gage easy to read. The indicator is located in a remote control station. X-ray scanning unit and main power cabinet make up the rest of the X-ray thickness gage. Its ultra-fast cycle allows the new gage to make use of high-speed electronic counting, marking, and sorting devices. It can also be used with production analyzers, and other devices.

Circle Item 125 on postcard, page 227

X-ray gage for checking thickness of fast-moving foil made by the Sheffield Corporation



Burgmaster auto-indexing, sensitive bench-model turret drill

Auto-Indexing Sensitive Bench Model Turret Drill

The Burgmaster Corporation, Small Tool Division of Burg Tool Manufacturing Co., Gardena, Calif., has announced their new auto-indexing, sensitive 3/16-inch capacity bench-model turret drill. This machine has been developed to meet the need for a sensitive production tool for use in the manufacture of small delicate parts requiring extreme accuracy. Numerous second operations, including drilling, tapping, reaming, counterboring, countersinking, and spot-facing, can be performed by one operator without moving the work-piece.

The drill has an overall height of 24 inches, is 17 inches wide and 20 inches deep. The machined pad is 8 by 12 inches, and the base 16 by 14 1/4 inches. The center of spindle to column clearance is 5 1/4 inches; chuck to base clearance, 7 1/4 inches; maximum tool extension from center, 8 1/4 inches; and maximum spindle travel, 2 3/4 inches.

The two-step timing belt drive provides the following twelve speed ranges: high range, 650 to 6200 rpm, and low range, 350 to 3300 rpm. Available accessories include drill chucks, tapping heads, sub-plate, floor cabinet with coolant pump, hose and lamp, and spindle extensions.

Circle Item 126 on postcard, page 227

Lodge & Shipley Lathes with Powershift Preselector

A line of lathes designed to provide substantial advantages in reduced costs and increased production has been announced by the Lodge & Shipley Co., Cincinnati, Ohio. The new machines, known as "Powershift Preselector Lathes," are available in size ratings of 13, 16, and 20 inches in engine, toolmaker, and gap models and in 45- and 90-degree Copymatic tracer-controlled types.

The operator can preselect the next speed to be used while the tool is cutting, thus reducing idle time. Using the correct cutting speed for each diameter minimizes tool wear, tool changing, and tool cost. Similarly, the correct cutting speed produces a superior finish and reduces subsequent finishing operations. Operator fatigue and errors are said to be materially reduced by the improved features incorporated in these lathes.

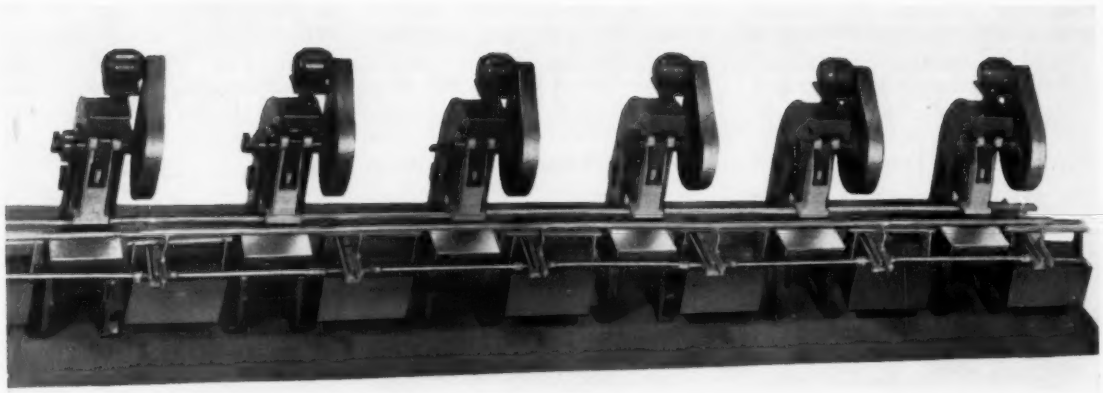
The headstock of the new lathe has but a single dial. The inner portion of the dial is stationary and is graduated in inches of diameter (of the work-piece or cut). The outer position of the dial is graduated in feet per minute, surface speed. Setting the outer dial instantly computes the spindle speed in rpm, and this figure, together with maximum safe horsepower, is shown in a small window.

This simple operation preselects the cutting speed. After the selection is made, automatic shifting of gears is controlled by the operator from his position at the carriage. With a convenient lever, he can start, stop, or shift speeds. In addition to the preselected speed, the operator can set up as many as six additional cutting speeds on the selector dial. Sequentially numbered tabs can be used to mark dial settings for these speeds.

Shifting of the gears in the headstock is accomplished by an electro-hydraulic mechanism. A hydraulic oscillator jiggles the gears to assure positive, damage-free shifting. The headstock design is such that electronic programming can be added to provide preselection of any number of speeds.

Circle Item 127 on postcard, page 227

Powershift Preselector Lathe announced by the Lodge & Shipley Co.



Open-back inclinable presses automated by Transflo feed mechanism and made by Clearing Machine Corporation

Feed Mechanism for Automating Line of Small Presses

A compact, versatile-feed actuating mechanism designed and built by the Clearing Machine Corporation, Chicago, Ill., now makes it possible to automate a line of open-back inclinable presses or other small press equipment. This "Transflo" feed is specially designed to transfer small work-pieces through a single press or through a line of up to six presses. The feed consists of a Clearing Transflo power unit and one intermediate unit for each press in the line. Still longer lines of presses can be automated by using more than one power unit.

Transfer fingers are easily replaceable to accommodate different work-pieces. The complete finger-bar assembly can be removed and replaced with an assembly that has been preadjusted for a particular job. In this way, down time during production changeover can be held to an absolute minimum.

Individual presses in an automated line can be dropped from automatic operation and be hand fed, while the rest of the line is operating automatically. This feed can be used with all standard sizes of open-back inclinable presses from 45 to 200 tons, or with other relatively small equipment, such as Series S straight-side crankshaft presses.

The physical dimensions of the feed permit handling surprisingly large work-pieces. The feed will clear a 37-inch front-to-back part dimension. The right-to-left dimension is limited only by the length of the feed stroke. Work weighing as much as eight pounds can be handled by the feed.

Circle Item 128 on postcard, page 227

Dust Collector Conversion Units for Grinders

The Standard Electrical Tool Co., Cincinnati, Ohio, announces that, in addition to their independent dust collectors for separate connection to grinding machines, they are now offering their two new "Grind-Air-rester" conversion units. Either of these units will instantly convert existing grinders into a compact arrangement that extends but a few inches beyond the back of the grinder.

The unit shown at the left in the illustration identifies the combination pedestal-cabinet designed to serve 7-, 8-, or 10-inch grinders. Dimensions are: *A*, 8 3/4; *B*, 11 3/8; and *C*, 26 3/8 inches. Floor space is 22 by 20 inches.

Unit seen at right has the capacity required for two 12-inch or two 14-inch grinding wheels. A dimension *A* of 16 inches and *B* of 12 inches is adequate to serve the average base mounting on a 2- or 3-hp grinder. The width *D* of the base measuring 17 1/2 inches identifies the required

Grind-Air-rester conversion units developed by Standard Electrical Tool Co.

clearance between the exhaust guards on the grinder. Dimension C is 32 1/2 inches.

Both of the units illustrated have a self-contained motor-driven dust collecting fan with efficient filtering units.

Circle Item 129 on postcard, page 227

Servomatic Tension- and Compression-Testing Machine

A 10,000-pound B-L-H Mark G Servomatic tension- and compression-testing machine in which the center of the test piece always remains at the same point regardless of the length of specimen or amount of extension has been developed and built by the Electronics and Instrumentation Division of Baldwin-Lima-Hamilton Corporation, Waltham, Mass. The center of test specimen, located 56 1/2 inches above the floor, is easily observed and allows auxiliary test equipment, such as ovens, to remain in a fixed position for the duration of any given test. Two moving cross-heads actuated by two ball and screw mechanisms provide the motionless center-of-test feature.

The two ball and screw mechanisms turn simultaneously in equal and opposite directions. Because one screw has a right-hand thread and the other, a left-hand thread, the cross-heads move in opposite directions as the screws are turned, separating to apply tension; moving together to apply compression. Because the same two screws move both cross-heads, the two heads move at identical speeds.

The 10,000-pound machine powered with a 3/4-hp motor gives a test movement of 20 inches per minute. For a 10-inch-per-minute test movement on the 60,000-pound Mark G machine, only a 2-hp motor will be required. In addition to testing samples in tension or compression, the machine is equipped to apply alternating loads. Automatic strain or load cycling is possible at frequencies of from 0.6 to 60 cycles per minute. An auxiliary plotter mounted in the console will plot load versus time and strain versus time simultaneously with the X-Y plotter.

Circle Item 130 on postcard, page 227

Cycoil Aftercleaner Built for Efficient Collection of Dust Particles

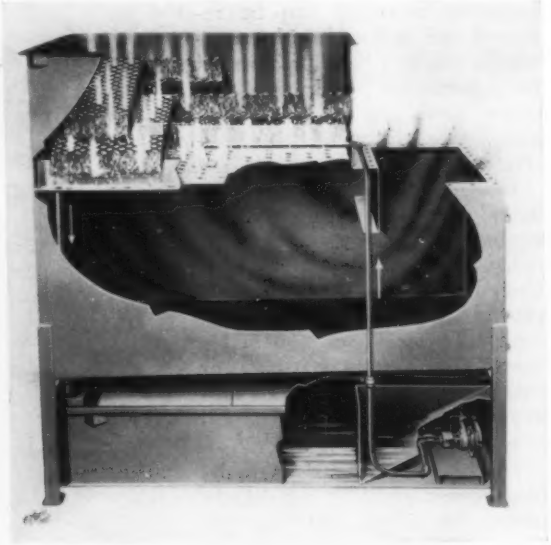
A redesigned Cycoil oil-bath aftercleaner has been introduced by the American Air Filter Co., Inc., Louisville, Ky. This new P-17 Cycoil is intended especially for collecting dust particles that might escape conventional dry centrifugal or viscous impingement filters. High collection efficiency is said to make this filter especially adapted for the solution of difficult metalworking dust problems encountered in machining cast iron and in performing tool-room grinding operations where oxidation is a problem.

A separate oil reservoir and sludge-settling tank facilitates sludge removal. The collected dust can be removed periodically while the cleaner is in operation. The tank may also be disconnected when system is not operating and taken to dumping point.

The high collection efficiency of this cleaner permits recirculation of the cleaned air back into the work-room. This is of primary importance on large air-volume installations where the savings in fuel is appreciable. On small or relatively low-air volume applications where fuel saving is not a factor, recirculation from the cleaner eliminates the cost of installing a discharge duct from the collector through a wall or roof.

Circle Item 131 on postcard, page 227

Baldwin-Lima-Hamilton Mark G Servomatic tension and compression tester



Cycoil aftercleaner introduced by the American Air Filter Co., Inc.

at EASTMAN KODAK

33% HIGHER PRODUCTION

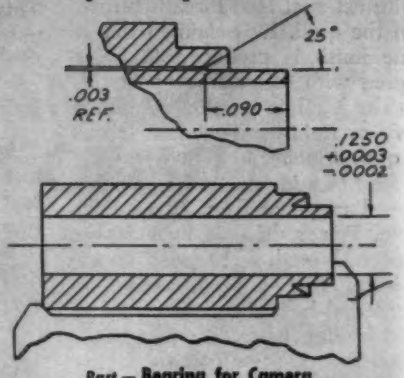
with new-design Brown & Sharpe Automatics

There is no better "proving ground" for automatic screw machines than Eastman Kodak. An endless volume and variety of precision parts are required for their big production of cameras and other photographic equipment. To meet this demand at the lowest cost, Kodak takes full advantage of up to 33% gain in their production, plus the additional increase in overall efficiency delivered by the new-design B&S No. 00 Automatics.

The production figures listed, for a movie camera bearing, are a good example of the savings realized on many jobs. The higher speed of the new No. 00 permits an increase to 7200 in cutting RPM from the previous 6000. Tolerances as close as .0005" are easily maintained. Because of the improved deep drilling efficiency, drilling time is 15% less, with longer drill life. The saving in time per piece is 3½ seconds.

Figure the comparable savings you can make, in your operations, with the extra speed, precision, adaptability,—the easier set-ups and extended tool life you get with new-design B&S Automatics. You'll see why so many buyers say, "They pay for themselves, in record time." For complete details, write: Brown & Sharpe Mfg. Co., Providence, R. I.

Production up from 257 to 342 pieces per hour



Part — **Bearing for Camera**

Material — **9/32" dia. Brass**

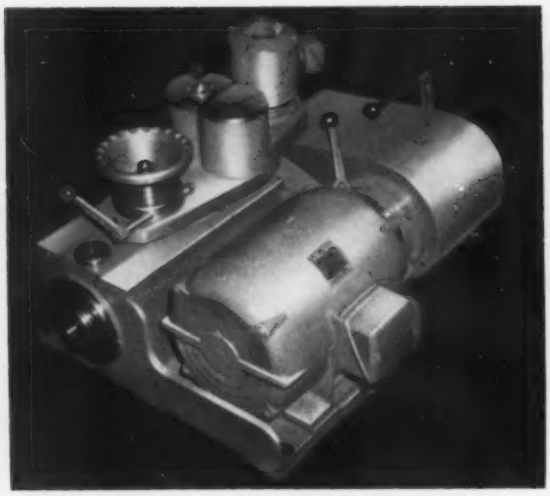
OLD DESIGN No. 00G		NEW DESIGN No. 00
6000	Cutting RPM	7200
14	Sec. per piece	10½
257	Pieces per hour	342

Brown & Sharpe

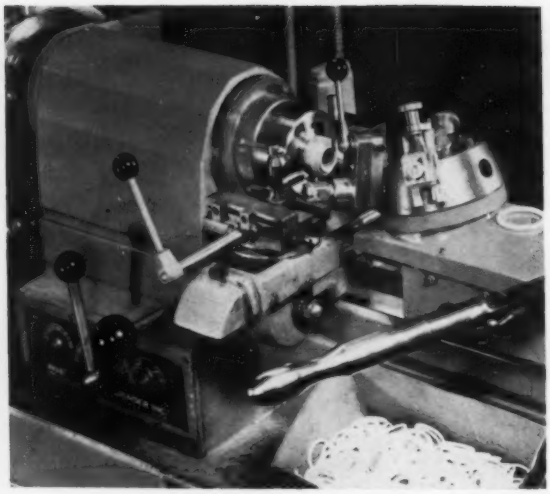
The home of PRECISION CENTER

MILLING, GRINDING, AND SCREW MACHINES
CUTTERS • MACHINE TOOL ACCESSORIES
PRECISION TOOLS • PUMPS

For more information fill in page number on Inquiry Card, on page 227



Fred-Tex precision milling head



Rivett lathe with large-size spindle

Precision Milling Head

The development of a milling head for horizontal or vertical mounting has been announced by Fred-Tex Machine, Inc., Fredericksburg, Texas. Designed so that head movement is prevented even under the most severe milling conditions, the milling head uses a large feed-nut thrust area with external feed threads turned on the quill. It is claimed that a fine finish is produced in holes bored with this worm-type quill.

The head is supplied in either left- or right-hand models. It has a quill 9 inches in diameter, with a feed of 8 inches, and a spindle-speed range of from 50 to 1590 rpm. Power drive is by a 30-hp motor through a 10-speed transmission that is constructed of hardened helical gears with large anti-friction ball and roller bearings. Two selector controls facilitate gear changing. A large, easy-to-read index-plate facilitates selection of the desired operating speed. The transmission is not a part of the head proper and thus eliminates the possibility of a distorting effect on the spindle from rapid expansion of the transmission under load.

Lubrication is through a self-contained system that exposes the transmission gears and bearings to a heavy oil mist at all times, regardless of load or speed. Other lubrication is by grease fittings.

Circle Item 132 on postcard, page 227

Lathe Equipped to Take Extra-Large Bar Stock

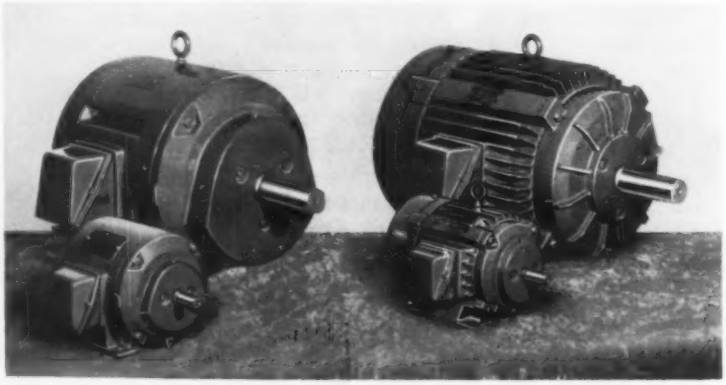
A 918 cabinet turret lathe made by the Rivett Lathe and Grinder Corporation, Brighton, Boston, Mass., has been equipped with a 2 1/2-inch capacity spindle to reduce stock preparation and speed production of plastic "O" rings, at the plant of the Crane Packing Co., Morton Grove, Ill. This large-capacity lathe eliminates the slow, previously used method of cutting plastic bar stock to length and then chucking it for the finishing operations.

The extra-large capacity permits feeding bar stock in lengths up to 20 feet directly through the spindle. In addition, by using adapters with a Sjorgren chuck, stock in sizes down to 3/4 inch can be handled.

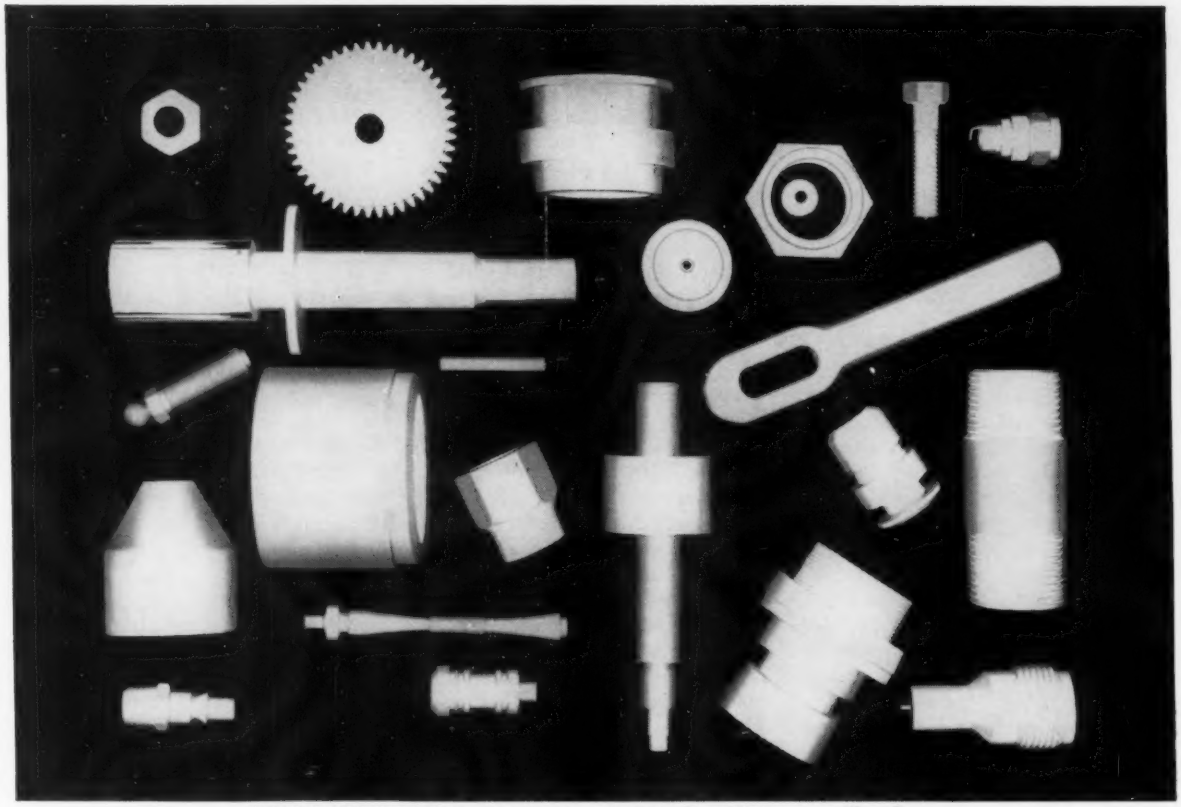
Circle Item 133 on postcard, page 227

Totally Protected Alternating-Current Motors

A complete line of totally protected, Series D alternating-current motors in the large NEMA Frame 364U through 445U sizes is now being introduced by the Reliance Electric and Engineering Co., Cleveland, Ohio. Foot-mounted and footless horizontal models in the 360 frame diameter are stocked in all standard enclosure styles—protected; totally enclosed, fan-cooled; corrosion-proof; and explosion-proof—for operation on 208- through 550-volt



Large-frame motors manufactured by Reliance Electric and Engineering Co.



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in-plant alternating current. Other new NEMA frame sizes through 125 hp., and with their modifications, are also being made available.

In NEMA electrical Design B, Design C, and Design D, the new line of large-frame motors may be specified in many speeds with Class A, Class B, or high-temperature Class H insulation. Part-winding starting, to eliminate loading of power-supply lines and resultant momentary light dimming, is available for commercial airconditioning and other applications with similar requirements. The new motors complement the present line of Reliance totally protected motors.

The protected enclosure, with a 40-degree C. temperature rise, is designed for applications which formerly called for splash-proof motors. The corrosion-proof motor has all cast-iron construction, self-cleaning ribbed frame, corrosion-proof cast-iron fan, a shaft slinger to prevent the entry of foreign particles along the shaft, a water-tight conduit box and hexhead bolts throughout for simple disassembly.

"Metermatic" lubrication gives a metered flow of lubricant to the bearings as needed to eliminate over-greasing or under-greasing.

Circle Item 134 on postcard, page 227

Brown & Sharpe Individual Radius Gages

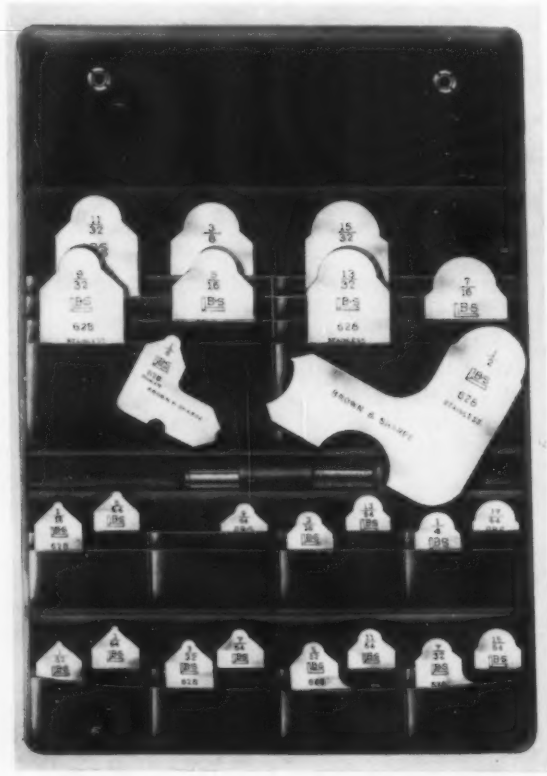
A series of new gages designed to provide the easiest and most precise way of checking radii from 1/32 to 1/2 inch has been announced by the Brown & Sharpe Mfg. Co., Providence, R. I. Each of these No. 628 radius gages has five different gaging edges, permitting both convex and concave radii to be tested even when recessed, and making the testing of corner radii easy. These gages are stainless steel, and furnished with an interchangeable holder which simplifies their use. They are available in three sets: 1/32 to 17/64 inch by 64ths; 9/32 to 1/2 inch by 32nds; and a combined set of both ranges. Individual sizes are also available singly. Sets come in a handy case with a holder.

Circle Item 135 on postcard, page 227

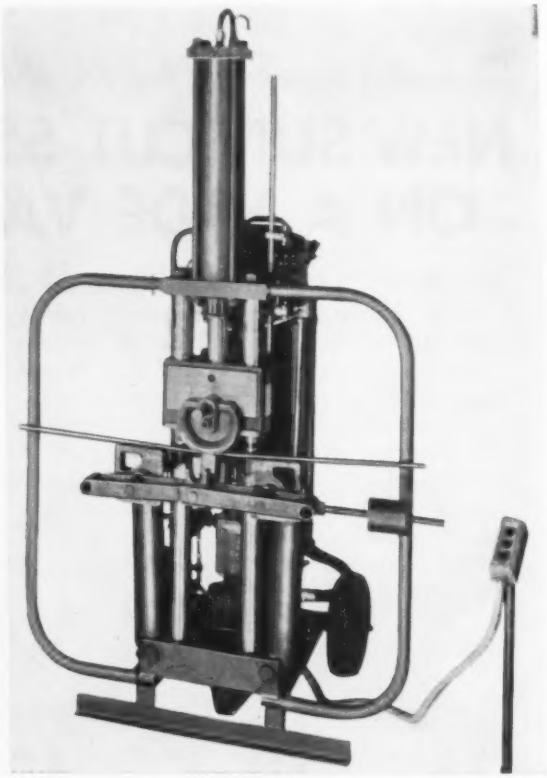
Wallace Vertical Ram Type Hydraulic Bender

A vertical ram type bender, designated No. 1402, planned to save space (floor space required measures 100 by 45 inches) and to facilitate handling of material being bent, is announced by Wallace Supplies Mfg. Co., Chicago, Ill. This machine will bend work to an angle of 180 degrees with no repositioning of dies or relocating of material. It will bend up to 2-inch heavy-weight steel pipe, producing coils, return bends, and special curves. Angle-irons, channels, reinforcing bars, flat bars, etc. can also be bent on this machine. Any desired number of uniform bends can be made by a simple initial setting of the duplicator.

Push-button control is provided



Set of individual radius gages announced by the Brown & Sharpe Mfg. Co.



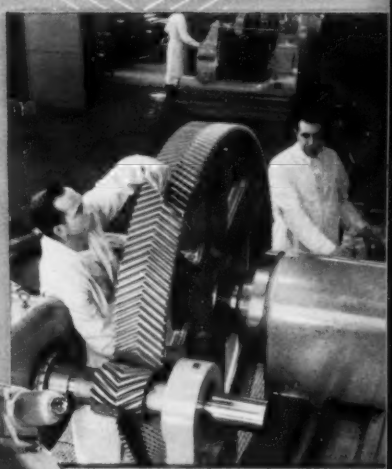
Vertical ram type hydraulic bender made by Wallace Supplies Mfg. Co.

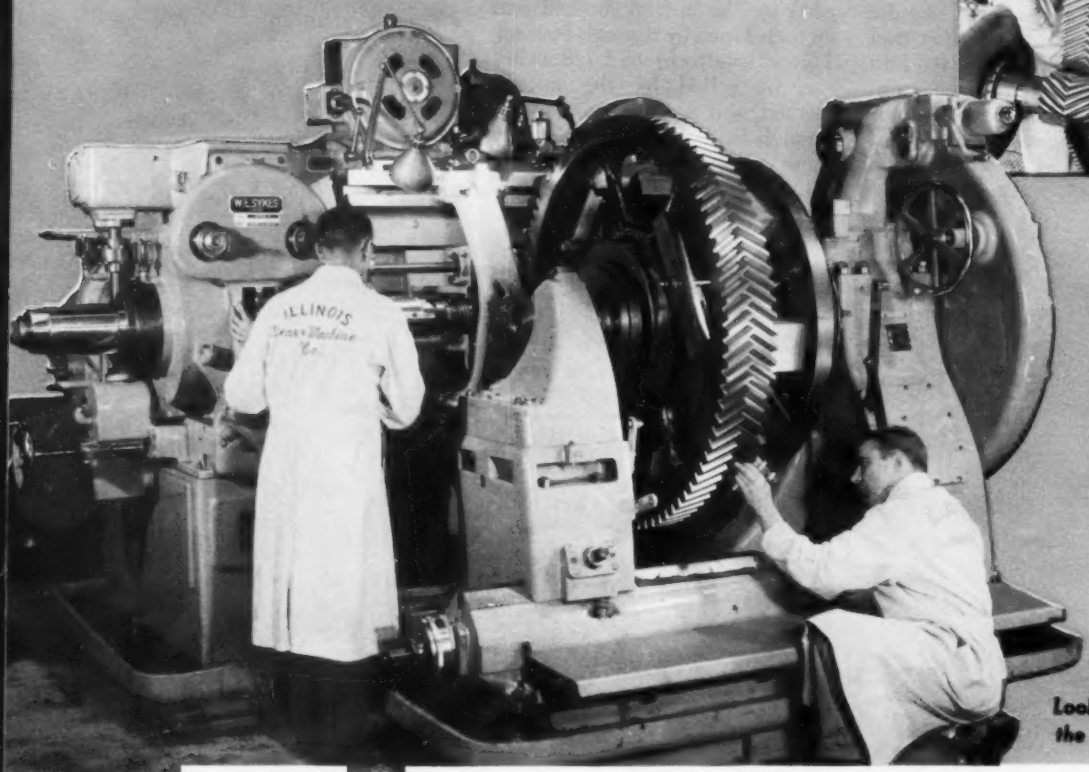
Here's how Illinois Gear makes sure of Quality in HERRINGBONE GEARS

If you could look down into the ILLINOIS GEAR plants you would see great batteries of the world's most modern gear producing equipment . . . manned by skilled craftsmen who *know* how to operate this equipment.

Typical of what you would see is the precision Herringbone Gear Generator and Testing Equipment, illustrated here. With unmatched facilities such as these ILLINOIS GEAR can produce one gear, ten thousand or more under the most exacting conditions of quality control . . . and meet delivery dates as promised.

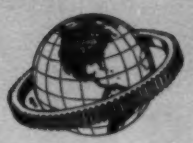
If you are not now using ILLINOIS GEARS find out about the gears that can be made in any quantity with quality as the first consideration, as thousands of customers can testify.





Power testing Herringbone Gears under actual operating conditions.

The Herringbone Gear Generator has a 66" diameter and 18" face capacity. Other generators up to 134" diameter, 54" face capacity.



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to assure maximum production output. A jog button enables setups to be made quickly from field measurements or lifted bend-wire templates. A motor-driven hydraulic pump mounted on the oil reservoir supplies pressure to a cylinder under push-button control. This cylinder carries the ram for the sliding head that is mounted on vertical bar type ways. The head carries the central bending die between two side dies in heads pivoted at the base of the bender for varying width or radius adjustment. The side dies rotate on studs as a single centrally located stationary die takes their place.

Circle Item 136 on postcard, page 227

Reed Cylindrical-Die Thread-Rolling Machine

A two-die type horizontal cylindrical-die thread-rolling machine has been announced by the Reed Rolled Thread Die Co., Worcester, Mass. This new Model B 111 machine is especially suited for high production and job-shop work and for both infeed and through-feed thread and form rolling on large and small production runs.

The machine is simple and entirely mechanical in operation. It is of rugged, compact design and can be easily and quickly changed over from one job to another. During the rolling operation, one die remains in a fixed position and the other is movable. It is fed into the work by means of a cam-actuated head which provides for positive control of the feed and size through uniform penetration rates and predetermined length of dwell. Fine micrometer adjustment provides for accurate final sizing.

Both dies rotate in synchronism. A simple, precise, rotary matching device offers a quick and positive means of positioning the threads on the dies in correct relation to one another, so that the dies track properly when contacting the blank. The dies always remain in matched position during rolling.

Standard work rest blades and standard work stops are available for in-feed rolling. Work diameters up to 2 inches can be handled by the in-feed method and up to 3/4 inch by through-feeding. Thread lengths up to 1 7/8 inches can be rolled by the in-feed method, and up to 20 feet by the through-feed method. The machine is operated by a 5-hp motor with push-button controls. A wide range of die and cam speeds are available.

The machine can be used for manual, semi-automatic, or completely automatic feeding. Floor space for the machine for in-feed rolling is 40 inches by 39 inches. Working height is 42 inches.

Circle Item 137 on postcard, page 227

Baird "Poliaction" Barrel-Finishing Machines

A series of barrel-finishing machines is being made by the Baird Machine Co., Stratford, Conn., under the trade name "Poliaction." The line features complete redesign of pedestals, with new drive and tilting-mechanism.

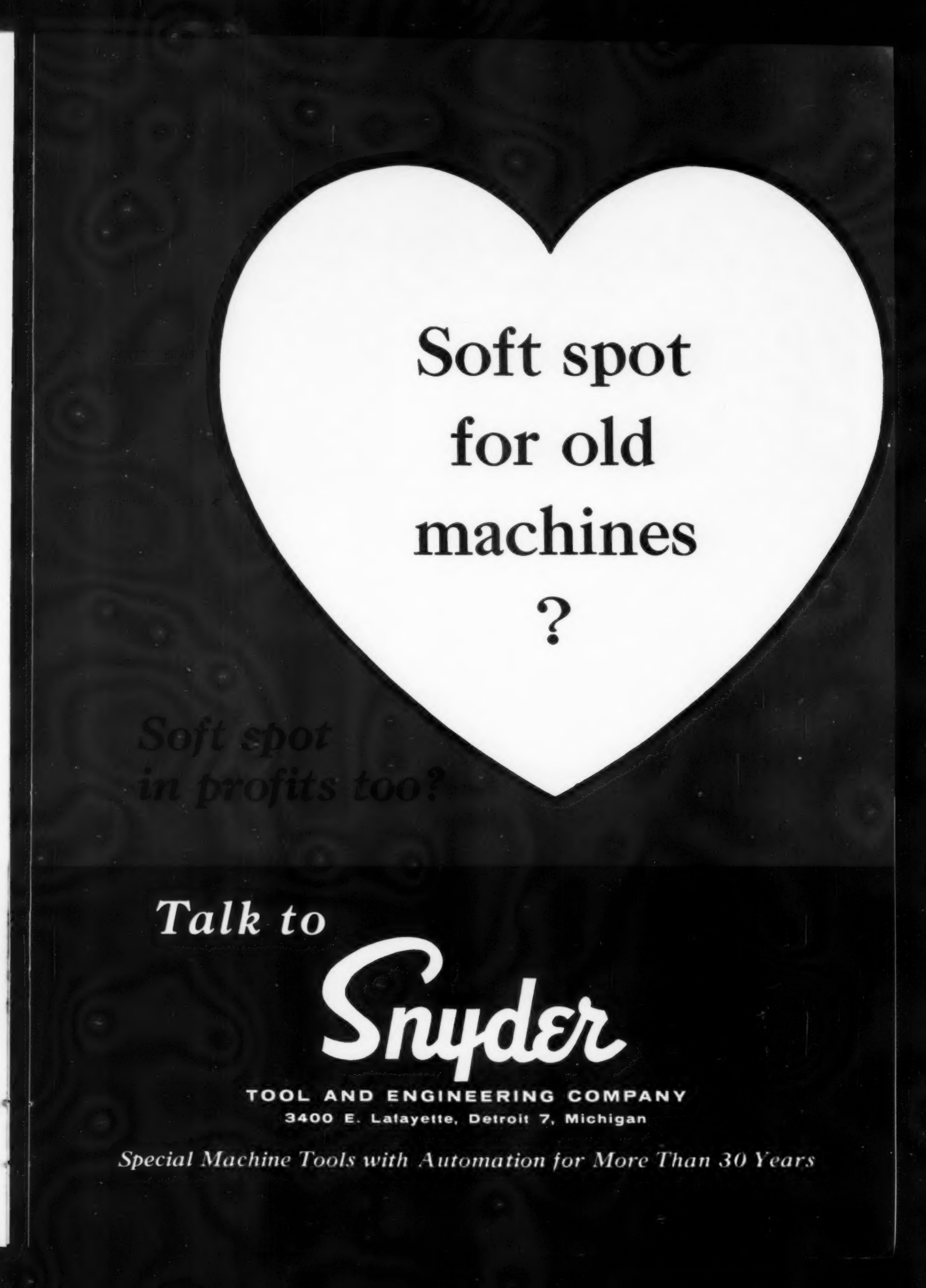
The machines are available in two sizes: No. 1 for barrels 13 to 22 inches, and No. 2 for barrels 22 to 36 inches. They may be ordered equipped with either push-button "Electratilt" or manual-hydraulic "Hydratilt" barrel control, and with either vari-speed motor or vari-sheave drive. Poliaction machines may be equipped with Baird barrels in a full range of sizes and types or they may be used with standard barrels of other makes.

Circle Item 138 on postcard, page 227

(This section continued on page 212)

Thread-rolling machine announced by Reed Rolled Thread Die Co.

Poliaction barrel-finishing machine made by the Baird Machine Co.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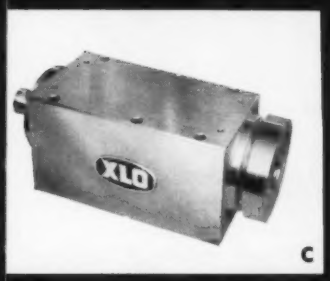

C

A

D

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E

A. Standard DB 24 Spindle
B. DB 50 Motorized Spindle
C. DB 25 Square Body Spindle
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Greater Accuracy—with Ex-Cell-O Precision Boring Spindles

No one need tell you of the proven superiority of Ex-Cell-O precision boring spindles where close tolerances and fine finishes are required. But, did you know that these same Ex-Cell-O boring spindles have been used as replacement units for years?

Produced in belt-driven, standard motorized, or high frequency motorized styles, these Ex-Cell-O precision spindles are equipped with XLO Precision bearings for maximum spindle rigidity, long life and smooth operation. Permanent bearing lubrication reduces maintenance costs, prolongs bearing life.

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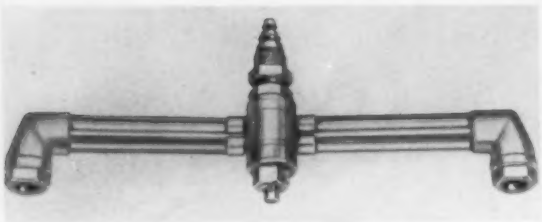


Straight-shank carbide chucking reamer introduced by Super Tool Co., a Division of Van Norman Industries

Duplex cutting torch for making simultaneous parallel cuts announced by the Air Reduction Sales Co.

Carbide Reamer

A straight-shank carbide chucking reamer of a line introduced by the Super Tool Co., Detroit division of Van Norman Industries, Inc., Detroit, Mich., is shown in the accompanying illustration. This design features a solid-carbide flute section instead of the usual carbide-tipped flutes. It is said to have greater rigidity, reduce chatter, and give longer productive life between grinds with less chance of breakage. It is also claimed that the new design offers considerable savings in cost over solid carbide construction. The new reamers are listed as RCB in decimal sizes 0.230 to 0.760 inch and RCS in fractional sizes from 1/4 to 3/4 inch.

Circle Item 139 on postcard, page 227

Airco Duplex Cutting Torch and Welding Electrode

A new accessory for use in making simultaneous parallel cuts with an Airco Style 4700 machine-cutting torch is announced by Air Reduction Sales Co., a division of Air Reduction Co., Inc., New York City. The fully adjustable duplex tip holder may be set to cut strips of any width from 1 1/4 to 12 inches, in plate thicknesses up to 3 inches. Tip separation is easily set without tools and without changing torch height. The minimum tip spacing of the new holder illustrated is less than that of the fixed holders now available and its range of adjustment enables it to replace Airco's entire line of fixed duplex holders.

Such operations as plate ripping and the simultaneous cutting of small pieces or inside and outside circles are greatly facilitated by use of the holder. It will accommodate acetylene, propane, or natural-gas tips. Although designed for machine cutting, this device can also be used in the Airco Styles 3000 and 9000 hand-cutting torches for particular applications.

A new electrode for use with small-transformer power sources in the all-position welding of light-gage mild steel has also been developed by Air Reduction Co. This Airco 90C electrode is designed for use where good penetration at rapid travel speeds is required. It features the easy-starting tip that arcs immediately under low-open circuit voltage. The arc is quiet and steady and the coating aids in controlling metal transfer. Complete slag coverage is maintained without arc interference.

The deposit is of excellent appearance: smooth, uniform, and normally convex. It meets X-ray standards for this type of electrode. Physical properties of the deposit, tested in accordance with A.W.S. specification A5.1-55T, are tensile strength, 76,400 psi; yield strength 66,500 psi; elongation in 2 inches, 24.5 per cent; and reduction of area, 51.0 per cent. The electrode is adapted for use in such applications as the welding of storage tanks, gear guards, metal furniture, and air frames. It is particularly suitable for use on farm-repair work and in job shops using small transformers.

Circle Item 140 on postcard, page 227

Kendex Tool-Holders and Throw-Away Inserts

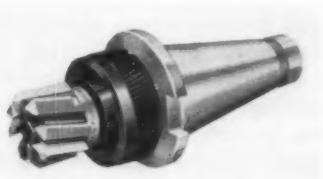
Heavy-duty Kendex throw-away insert tool made by Kennametal Inc., Latrobe, Pa. Large triangular carbide inserts (5/8-inch inscribed circle and 1/4 inch thick) are used in three styles of holders. Style KTD-86A holders are for heavy plunge cutting on tracer control or automatic lathes. Style KTF-86A is for turning or facing to a square shoulder, and Style KTG-86A is an offset tool for shaft turning or facing to a square

shoulder. All holders are of heat-treated alloy steel and have a hardened-steel clamp and solid carbide shim or seat. Kennametal inserts are available in precision (all surfaces ground) or utility (ground top and bottom) types.

Circle Item 141 on postcard, page 227

Quick-Change Cutter Holder

Heavy-duty quick-change cutter holder especially suited to heavy cutting in die-sinking and similar operations manufactured by the Universal Engineering Co., Frankenmuth, Mich. The holder is one



69.5 out of every 100 GRAND RAPIDS SURFACE GRINDERS sold, are purchased by firms already owning one or more — 30.5 by new customers.
Once you've enjoyed the advantages of a Grand Rapids Grinder in your plant, chances are, like so many present users, you'll surely want more of them.
GALLMEYER & LIVINGSTON
Write for 24-page book that tells you why.
GALLMEYER & LIVINGSTON CO.
305 Straight Ave., S.W., Grand Rapids, Mich.

in a line of adaptors which the manufacturer calls the "Kwik-Switch" type. The heavy-duty holder is so designed as to be interchangeable with the regular line of Universal adaptors. The 3-piece device is designed to provide a positive square drive, back-up screw stop and depth adjustment. A collet type adaptor, designed for pre-setting, is furnished with the holder.

Circle Item 142 on postcard, page 227

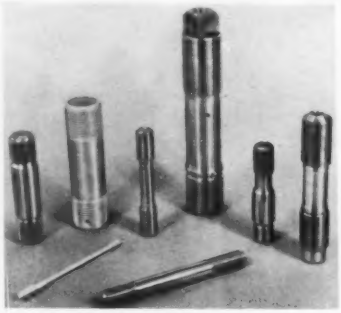
Wesco Tool Mist Unit

Tool mist unit designed to keep cutting tools cool during operation, increase cutter life, and speed up production. This unit, developed by the Wesco Tool & Mfg. Co., Burbank, Calif., is recommended for use on drill presses, lathes, grinders, saws, abrasive belts, milling machines, and almost any type of machine that requires coolant. Moist coolant from the unit serves to reduce friction and heat, thus keeping the tools cool. The Wesco mist process makes it possible to apply coolant in combination with air in such a way that the coolant actually dissipates in the air and no coolant pan is necessary.

Circle Item 143 on postcard, page 227

High-Strength Studs

Special high-strength studs for power-plant steam turbines, nuclear-reactor equipment and a variety of other high-temperature, high-pressure fastening jobs is available as a customer-engineered product line from Standard Pressed Steel Co., Jenkintown, Pa. These studs are made in sizes ranging from 1/2 inch to 6 inches in diameter and from 6 to 72 inches in length, some weighing as much as 800 pounds. They are made from a variety of high-strength, high-temperature, and corrosion-resistant alloy steels and can be supplied with tensile strengths of 220,000 psi or more for moderate temperature applications and as high as 170,000 psi for use at temperatures of 900 degrees F. Precision threads are



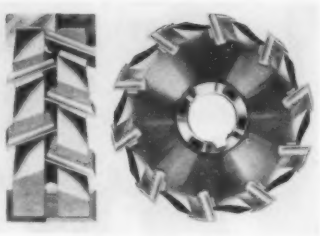
rolled after heat-treatment into studs up through 4 1/2 inches in diameter. Threads on studs larger than 4 1/2 inches are ground after heat-treatment. Surface finishes as fine as 20 micro-inches are held over completed studs.

Circle Item 144 on postcard, page 227

Combined Drill and Reamer

Special Tool designed to drill and ream a pilot hole in one operation. This combined drill and reamer is typical of the many special tools made to customer drawings and specifications by Chicago-Latrobe, Chicago, Ill.

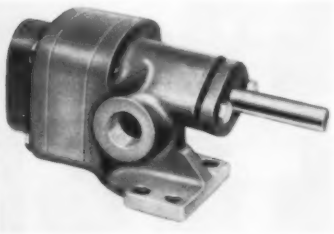
Circle Item 145 on postcard, page 227



Inserted-Blade Interlocking Side-Milling Cutters

Inserted-blade interlocking side-milling cutters for channeling aluminum and magnesium alloys introduced by Goddard & Goddard Co., Detroit, Mich. These cutters are easily expanded to meet slotting width variations. The use of inserted blades with a two-piece body permits shimming between the two sections to maintain the specified width without resetting the blades. Sufficient interlock is maintained throughout the cutter's adjusting range. Total adjustment available is 3/16 to 5/16 inch, depending on the width of the cutter body. The cutters are coarse pitch with ample chip room and chip spaces are polished to facilitate chip disposal. They are made to order with diameters ranging from 5 to 16 inches.

Circle Item 146 on postcard, page 227

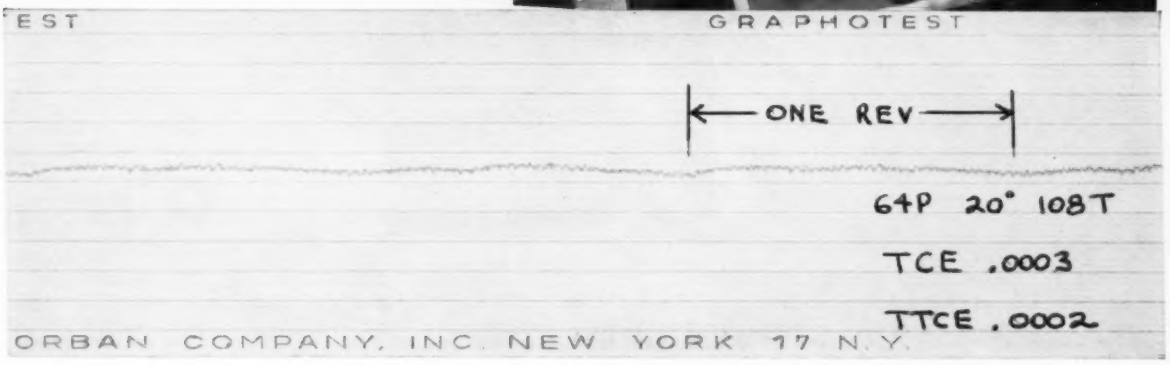


Worthington Heavy-Duty Rotary Pump

Heavy-duty, herringbone-gear rotary pump designed to meet the need for an efficient, economical, high-pressure pump announced by the Worthington Corporation, Harrison, N. J. This pump is available in sizes 1 through 4, and is applicable to small hydraulic systems for oil-burner service, filtration systems, and circulation service, and any other application requiring a low-cost, heavy-duty

why General Mills checks every precision production gear on the S&F gear tester...

General Mills' inspector running a production gear in one of four S & F Testers. Note extreme sensitivity of instrument on Graphotest record.



because...

there's no gear tester as accurate as the S & F

Checking gears by the usual methods just isn't accurate enough to satisfy so precision-minded a producer as the Mechanical Division of General Mills. They know that their gears can be only as accurate as the instruments that test them—and only the S & F Gear Tester measures up to the highest precision standards.

Strong statement you say? Several hundred S & F Testers prove it every day in plants that took their gear accuracy seriously enough to change over to S & F—guaranteed to repeat within .00002".

Ask us to show you why this instrument is revolutionizing gear checking. Or talk to the S & F user near you. We'll send you his name.

KO CO., INC. PRECISION MACHINERY

KURT ORBAN

COMPANY, INC.

42 Exchange Place, Jersey City 2, N. J.

For more information fill in page number on Inquiry Card, on page 227

pump for continuous service at pressures up to 500 psi in capacities to 25 gallons per minute. The pump has suction and discharge openings from 1/2- to 1-inch N.P.T. size, and its simple but rugged construction incorporates few operating parts. Outstanding features of the new pump include four force-feed lubricated roller bearings, replaceable steel-backed bronze wear plates; and single stuffing box available with packing or mechanical seal.

Circle Item 147 on postcard, page 227

Ruthman Coolant Pump with Triple Discharge

Rumaco motor-driven coolant pump for machine tools with outside mounting flange developed by the Ruthman Machinery Co., Cincinnati, Ohio. This model has three discharge outlets—one on the right side, one on the left side of the housing, and one, optionally tapped, through the inlet port of the mounting flange. These discharge openings may be used individually, in pairs, or simultaneously. Model 5S-4520 is available with either 1/10-hp, 3450-rpm or 1725-rpm motor; and in 1/4 hp at 3450 rpm, equipped with self-adjusting pretested seal. The maximum over-all height of the 1/4-hp size is 13 3/16 inches and the 1/10-hp size is 11 7/16 inches. Impellers of various diameters are available for capacities up to 30 gallons per minute.

Circle Item 148 on postcard, page 227

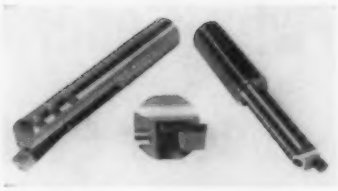
Molded Rubber Pad and Coated Abrasive Disc for Contour-Polishing

Mushroom-shaped molded rubber pad and coated abrasive discs for contour-grinding or polishing in small radii or difficult contours with portable tools developed by Behr-Manning Co., Troy, N. Y., a division of the Norton Co. Discs are held to the pad by a special adhesive packaged in tube applicators. Abrasive discs are made in Resinall Metalite cloth, an aluminum oxide abrasive with an all-resin bond, in grits 120-X, 80-X, and 50-X. Pads 5 and 8 inches in diameter are made in the proper density for polishing; a third mushroom pad 5 inches in diameter is made in a harder density for stock removal. All may be used on any portable pneumatic or electric grinder.

Circle Item 149 on postcard, page 227

Buck Boring-Bar

Buck boring-bar developed by Buck Tool Co., Kalamazoo, Mich., to provide greater rigidity for heavier, faster cuts—with standard and carbide-tip cutters—and to perform boring and counter-boring operations with one tool. The three views of the boring-bar point out its design features: front view (left) shows how cutter overhang is minimized to increase strength and rigidity; side view (center) illustrates how full shank of cutter is held firmly by three locking screws; and view (right) shows screw at end that adjusts cutter for close tolerance work. Standard cutters can be used. Since cutting edges are always on center, tip grinding is minimized. Made in thirty sizes.



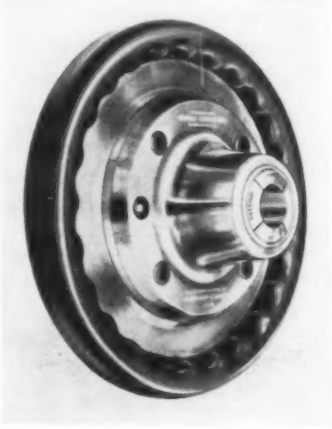
Circle Item 150 on postcard, page 227

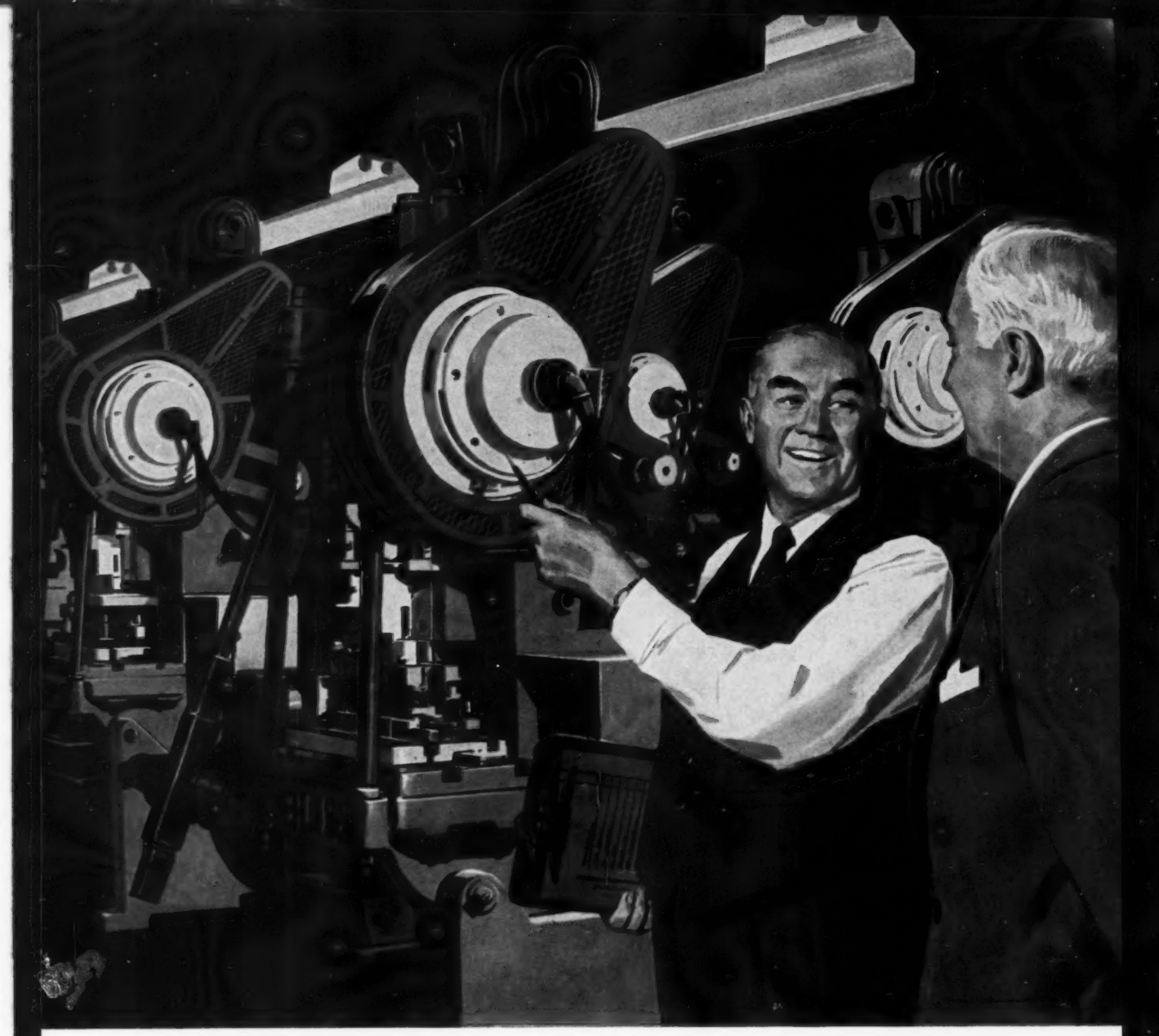
Hardinge-Sjogren Speed Collet Chuck

Hardinge-Sjogren speed collet chuck announced by Hardinge Brothers, Inc., Elmira, N. Y. This chuck is designed for use on all types of toolroom lathes, engine lathes, and grinders. It has been developed to assure accurate holding of any bar that can be passed through the spindle and without requiring the use of draw tube and adapter or sleeve inside the spindle hole. A full range of light-to-heavy holding power is possible without the use of keys or wrenches. The chuck uses low-cost regular steel collets. Complete operation from the front position is possible with the handwheel or lever-operated type Hardinge-Sjogren chucks. Handwheels are supplied in either 7 3/4-inch or in 10-inch diameter sizes.

Circle Item 151 on postcard, page 227

(*This section continued on page 218*)





"These 'super-speed' inclinables give me twice the production . . .

at about half the cost!" From their special vibration-absorbing legs to their counterbalanced shafts, these presses are built for speed.

With such special features as bronze gibs . . . automatic lube systems . . . special clutches, brakes and flywheels, and equipped with precision feeds, they can knock out short stroke work at better than 500 strokes a minute! They're all new, all Bliss, and the cost is low—surprisingly so.

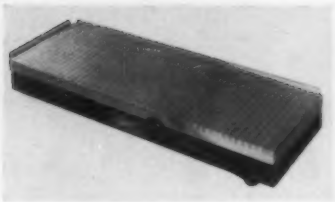
These are the latest members of Bliss' line—the line that offers industry its most complete choice of types and sizes. And with no axe to grind for any one type, you can be sure of impartial pressroom counsel—by Bliss.

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.



Permanent Magnet Chuck

Permanent magnet chuck (patent applied for), designated No. 824, with work surface 8 1/4 inches wide by 24 inches long, brought out by the O. S. Walker Co., Inc., Worcester, Mass. This is the fourth and largest chuck in the manufacturer's new line. The ceramic magnets of this chuck are said to have many times the coercive force of ordinary alloy magnets. Bar poles only 1/4 inch wide give uniform holding power over the entire chuck top, even on very thin parts. Secondary external fields are cancelled to prevent magnetism from entering machine table or ways. In the "off" position, the chuck is completely demagnetized. When milling or planing, the cutting tool is automatically subjected to a demagnetizing influence during the cutting cycle because the magnets are polarized horizontally.

Circle Item 152 on postcard, page 227

Vickers Flow-Control Valve

Pressure-compensated flow-control valve which makes corrections for flow variations due to fluid temperature changes announced by Vickers Incorporated, Detroit, Mich. This new valve replaces twelve models in the flow range of 5 to 1000 cubic inches per minute. Average flow variations, due to temperature changes, have been greatly reduced. A single adjustable throttle is used for all flow rates from 5 to 1000 cubic inches per minute, and an integral check valve permits reverse free flow at a maximum rating of 1400 cubic inches per minute. Flow-rate adjustment is tamper-proof, and a set-screw that can be locked in place with a key prevents further adjustment. The valve is available for either gasket or sub-plate mounting and is interchangeable with the old models except for the drain connection. New sub-plates will not have a drain connection. An optional anti-jump feature may be incorporated in the control valve, which reduces the hydrostat-inlet

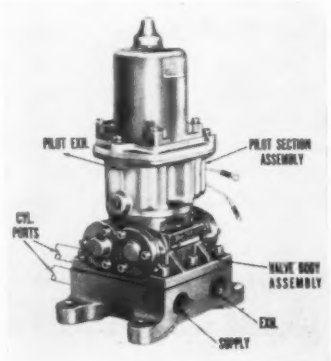
opening and decreases the volume of oil passed with sudden surges of inlet pressure.

Circle Item 153 on postcard, page 227

Ross Goldmodel Valve

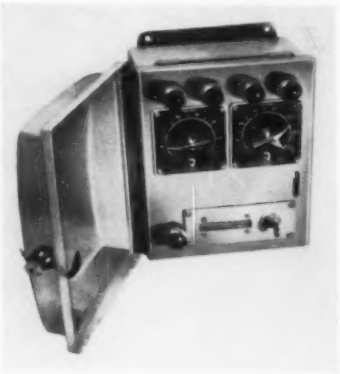
Latest addition to the skyline series of the Ross Operating Valve Co., Detroit, Mich. This Goldmodel valve with locking manual actuator is equipped with O-ring seals. The large-capacity pilot section built for long-life service is actuated by a new oil-immersed solenoid. Built to JIC standards, the valve is designed for spring-actuated return to normal operation or to be easily locked in the actuated position. A 90-degree turn of the actuator will lock the solenoid in the energized position.

Circle Item 154 on postcard, page 227



Counters for Controlling Tool Life

"Toolitrol" counter unit designed for installation as an accessory on single- or multiple-spindle machines, introduced by Scully-Jones & Co., Chicago, Ill. This counter is designed to take the human element out of resharpening procedures and permit major cost reductions by controlling tool-change periods. Significant savings are said to be possible through the use of this counter on machines requiring the use of relatively expensive cutting tools, such as broaches, hobbers, gear shapers, etc., or in any integrated production line where machine down time is a major factor. Equally important in many of these operations is the fact that changing cutting tools at the right time prevents manufacture of expensive parts that would either have to be reworked or scrapped. The Toolitrol counters provide a visible signal for the operator or supervisor and prevent anyone serving several machines from overlooking the need for a tool change. Furthermore, the counters can be provided with an optional relay for shutting down the machine when the counter reaches zero, making certain that an overly dull tool is not in use. Six basic models of Toolitrol counters are available, having from one to six switches. In addition, 15-count switch ranges can be provided. The available ranges begin with 0 to 72, and go as high as 0 to 54,000.



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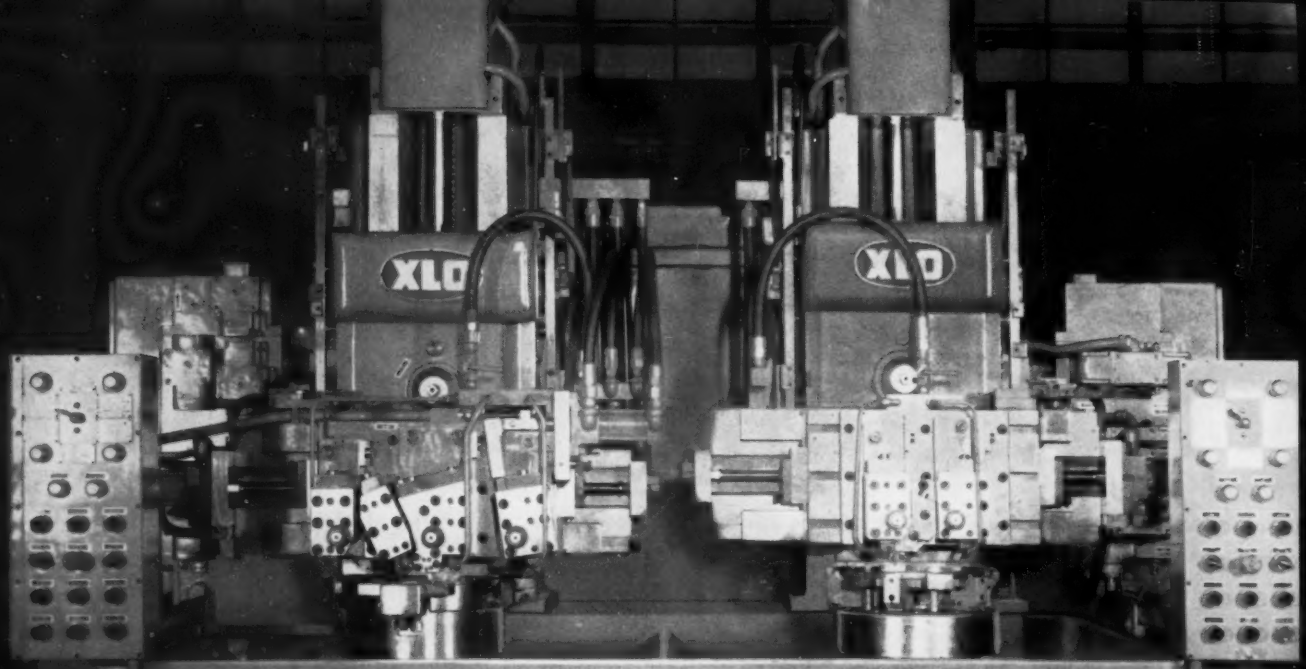
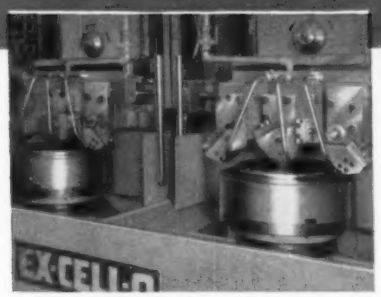


Twin spindles Double work capacity



This arrangement uses a magnetic chuck to hold an automotive part for processing.

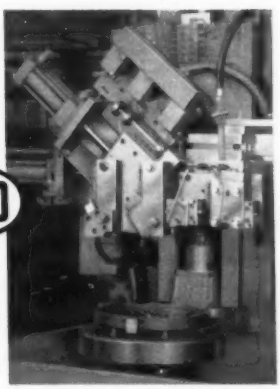
A single operator on this Ex-Cell-O Vertical can precision turn, bore, face, groove and chamfer two identical or completely different work-pieces simultaneously. All operations may be performed singly or in combination, and don't overlook the loading ease and tool accessibility of this vertical boring machine.

Ex-Cell-O engineers have cut maintenance time to barest minimum by locating service parts within easy reach. Yet overall design of this machine is clean and compact.

No doubt you are interested in increasing your production output. Call your nearby Ex-Cell-O representative for a conference today. His suggestions cost you nothing—and may save you a considerable sum. Or get in touch with Ex-Cell-O in Detroit directly. We would appreciate the opportunity of putting our years of specialized experience in the machine tool field at your disposal.

XLO

EX-CELL-O FOR PRECISION

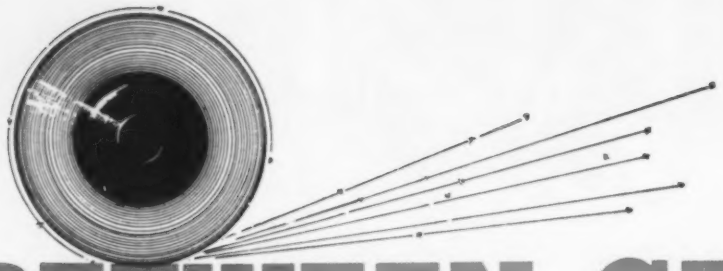


The Style 432 machine as fitted with an auxiliary slide for angular cuts.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

57-20

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING & BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS & BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT & MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



By E. S. Salichs

BETWEEN GRINDS

No Place Like Dome

A stressed skin aluminum dome, developed by the Kaiser Aluminum & Chemical Corporation and first for industrial use, will be built at Abilene, Kan., to house the Fi Fo Conveyor Co. The dome will be 145 feet in diameter and 49 1/2 feet high. With no pillars or other interior supports to lean against, the workers, we assume, will simply have to keep moving.

Paint it Pink, Said the Clink

The auto repair shop at Iowa State Penitentiary, looking around for a project that could be carried out legitimately, persuaded its educational director to purchase a demolished 1940 Hudson for $12 and have it towed into the prison. With discarded parts from twelve different auto makes, the inmates handbuilt what is now a pink sports car with zebra upholstery capable of running at 100 miles per hour. According to *Steelways*, which reported this achievement, the convicts presented the car to the director who is helping them rebuild their lives—the one sports car whose driver, we feel, will observe traffic regulations.

Empty Paint Cans, Up You Go

Aluminum pellets were recently shot through the air at 33,000 miles per hour in another attempt to understand upper atmosphere chemistry. With such a variety of things being projected upward these days, we finally got the idea of what to do with the mess in the garage.

The Long Look

A 90-foot aluminum tube with intricate mirror and lens system has been constructed by the General Electric Co. According to *Industrial Research Newsletter*, the periscope, world's longest, will permit atomic workers to sit safely behind heavy shielding while watching test of a nuclear reactor. A thrill for the nearsighted, too!

Who Has the Oldest Lathe?

Machine tool distributors are searching for the oldest American-made engine lathe actually in use within the continental limits of the United States. Get your entry in by January 15, 1958 to the American Machine Tool Distributors Association, 1900 Arch St., Philadelphia 3, Pa. The contest is limited to members of the Association and their employes. First prize is $100. Why not use the prize money to buy a new lathe for the poor unfortunates using the prize-winning antique?

The Melody of the Motor Lingers on

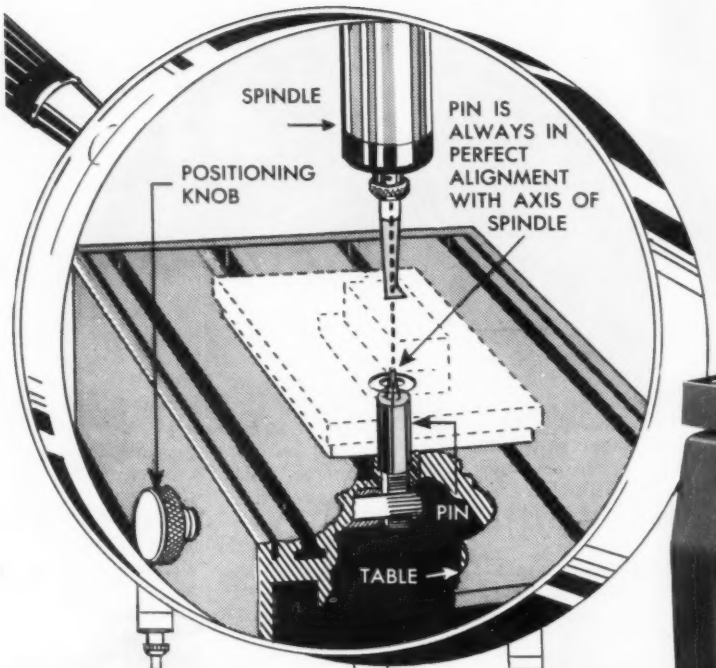
A hi-fi documentary record devoted to sounds of the automobile from 1906 to 1956 has been released that you might find entertaining. Sit back in an easy chair in your livingroom, close your eyes, and try to identify roaring engine noises—the 1906 Cadillac, the Stutz, the Stanley Steamer, and so on up to the 1956 Italian Ferrari.

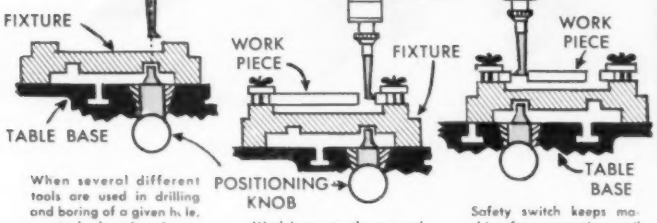
AND THE GAVEL GOES TO—Charles O. Herb (right), Editor of MACHINERY, who was recently elected president of the Society of Business Magazine Editors for 1958, on which occasion the retiring president, William A. Phair (left), Editor of *Hardware Age*, congratulated him. The Society holds meetings in Washington and other cities, its aim being the betterment of the business press, as well as a meeting of the minds. Editors and associate editors of approximately 140 prominent technical and business magazines constitute the membership. Other officers elected, all editors of their respective magazines, were: First vice-president, Colin Carmichael, *Machine Design*; second vice-president, Frank Richter, *Modern Railroads*; and secretary-treasurer, George F. Sullivan, *The Iron Age*. Editors Frank G. Steinebach, *Foundry*, and Norman H. Jacobson, *Electric Light & Power*, were elected to the Executive Committee.

THE CANTON PRECISION HOLE BORER

FOR PRODUCTION CENTER-DRILLING, DRILLING, BORING

Reproduces in quantity and at *low cost* parts that would have to be made on a jig borer





When several different tools are used in drilling and boring of a given hole, no tool changing is required until all first operations are completed.

Work is constantly exposed for easy checking and chip removal.

Safety switch keeps machine from operating until locating pin is positively in position.

- Up to 8 times faster than other jig boring methods
- Does not require skilled machinist operator
- Guaranteed hole spacing accuracy to .0001" of true position
- Exceptional savings in design time, manufacture and maintenance of tools

PIN BELOW POSITIONS WORK PRECISELY AND RAPIDLY

THE CANTON TOOL MANUFACTURING COMPANY | EAST CANTON, OHIO

News OF THE INDUSTRY

California and Colorado

KENNETH C. EDSON has been appointed Los Angeles district sales manager of Kelite Corporation, Berkeley Heights, N. J. Mr. Edson's headquarters will be at Kelite's Los Angeles facility.

LAKE ERIE MACHINERY CORPORATION, Buffalo, N. Y., has announced the appointment of ARCHIE J. SMITH as West Coast representative. Mr. Smith's office will be located in Van Nuys, Calif.

FIRTH STERLING INC., Pittsburgh, Pa., officially marks the opening of its new tungsten-carbide sintering facilities, Los Angeles, Calif., on January 3, 1958.

R. E. DUBOC, formerly executive vice-president of HECKETHORN MFG. & SUPPLY CO., Denver, Colo., has recently formed his own business as a machine tool representative and distributor. His company will be known as R. E. DUBOC ASSOCIATES, Denver, Colo.

Illinois and Missouri

CLEARING MACHINE CORPORATION, Division of U. S. Industries, Inc., Chicago, Ill., has announced the following appointments: EUGENE P. CUNNINGHAM has been named vice-president in charge of sales administration. He joined the corporation in 1934. ERVIN J. BAUMRUCKER has been appointed vice-president in charge of domestic press sales. Mr. Baumrucker joined the corporation twenty-one years ago.

THOR POWER TOOL CO., Chicago, Ill., announces the following appointments: WILLIAM J. MCGRAW has been appointed general sales manager; WALTER G. MITCHELL, general manager of product development; and MILTON E. SLATER, sales manager of farm and ranch division, all newly created positions. CLARENCE B. BERGREN, Milwaukee branch manager, has been named manager of Thor electric and SpeedTool sales.

DOALL CO., Des Plaines, Ill., has announced a toolmaker's microscope for the inspection and measurement of drills, taps, jigs, templates, broaches, milling cutters, reamers, and small work parts. This new aid to measurement accuracy is manufactured by Bausch & Lomb and will be sold exclusively by DOALL.

SUNDSTRAND MACHINE TOOL CO., Rockford, Ill., has announced that G. J. LANDSTROM, financial vice-president and treasurer of the company, was elected financial vice-president and secretary to assume the secretarial post left open by the death of his brother, Edgar Landstrom, in October. JAMES W. ETHINGTON, assistant treasurer and controller, was elected treasurer and controller.

G. J. Landstrom, vice-president and secretary, Sundstrand Machine Tool Co.

DANLY MACHINE SPECIALTIES, INC., Chicago, Ill., has announced the appointment of MOTCH & MERRYWEATHER MACHINERY CO. as exclusive distributor of the Danly line of mechanical presses and special hydraulic machinery. The distributorship area covers the Motch & Merryweather territories with offices in Cleveland, Cincinnati, Detroit, Dayton, and Pittsburgh.

MATTISON MACHINE WORKS, Rockford, Ill., has appointed J. LEE HACKETT CO., Detroit, Mich., sales and service representative in Michigan.

The Onsrud Machine Works, Inc., Machine Tool Division, Niles, Ill., has appointed the Bud Watts Machinery Co. as representative. The company will serve Onsrud customers in Tennessee and Arkansas.

DON T. MCLENNON has been appointed direct salesman in New England for the Cutter Division of

(Left) E. P. Cunningham, vice-president in charge of sales administration, and Ervin J. Baumrucker, vice-president of domestic press sales, Clearing Machine Corporation, Division of U. S. Industries, Inc., Chicago, Ill.

57-75

Here's Why Continental Counterbore Drives

Never Bind! Never Fail!

Continental Counterbores operate precision smooth and detach with a *twist of the wrist* because the driving forces generate *compressing* not *shearing action* in the holder. They never bind, deliver long-lasting, trouble-free operation.

In Continental Counterbores, you get extra torsional rigidity because drive lugs are close to the seating shoulder of the cutter. Double lugs on the cutter engage double abutments in the holder to form a powerful tool. But best testimony to the satisfaction you get from these counterbores is this: *no one has ever reported failure of a Continental Counterbore Drive!* For more information, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit. Available individually or in a choice of three sets.

CTW Continental TOOL WORKS

DIVISION OF

EX-CELL-O CORPORATION, DETROIT 32, MICHIGAN

the Ingersoll Milling Machine Co., Rockford, Ill. The territory consists principally of Connecticut, Rhode Island, and Massachusetts.

JOSEPH D. GAVIN has been appointed manager of sheet and strip sales at the Chicago plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill.

ALVA ALLEN INDUSTRIES, Clinton, Mo., has announced an agreement to increase the representation territory of R. J. R. KELLEY CO., East Orange, N. J. This company represents the Alva Allen Industries in New York, New Jersey, Pennsylvania, Maryland, Delaware, Maine, New Jersey, Vermont, Massachusetts, Connecticut, Rhode Island, and the District of Columbia. PAUL WATTS INC., San Francisco, Calif., has been appointed representative for California, Oregon, Washington, and western Nevada. HAZERODT ASSOCIATES, Royal Oak, Mich., is the company's representative in Indiana, Kentucky, Ohio, Michigan, and West Virginia.

Michigan and Wisconsin

CHRYSLER CORPORATION, Detroit, Mich., has announced the following appointments: V. P. MASI has been named plant manager of the Joseph Campau engine plant and W. R. GERBER, plant manager of the Conant Stamping plant of the corporation's Stamping Division.

MICROMATIC HONE CORPORATION, Detroit, Mich., announces the election of KIRKE W. CONNOR as chairman of the board, and DON S. CONNOR as the president and general manager.

Don S. Connor, president and general manager, Micromatic Hone Corporation.

Byron G. Behrens, sales application engineer, Seattle, Wash., office, Vickers, Inc.

BYRON G. BEHRENS has been appointed sales application engineer in the Seattle, Wash., office of Vickers, Inc., Detroit, Mich.

DETROIT TAP & TOOL CO., Base Line, Mich., has appointed WETZEL TOOL SALES CO. as stocking distributor throughout Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island. In the Boston area Wetzel's sales representative is ROBERT LUFKIN, Lynn, Mass.

WAYNE J. NEAGLES has been named general sales manager for Turchan Follower Machine Co., Dearborn, Mich.

J. D. HARMISON has been appointed sales manager, material handling, BUDA DIVISION, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

J. D. Harmison, Sales manager, material handling, Buda Division, Allis-Chalmers Mfg. Co.

New England

NEW DEPARTURE DIVISION, GENERAL MOTORS CORPORATION, Bristol, Conn., announces that C. FREDERICK CROW has assumed the position of Bristol plant manager. He succeeds ROBERT H. WILKIE who is now engaged in special assignments with New Departure's sales organization.

Taft-Peirce Mfg. Co., Woonsocket, R. I., announces the appointment of the GEORGE D. MILLER CO., Cleveland, Ohio, as representative.

E. F. MITCHELL has been appointed vice-president and sales manager, Vitrified Wheel Co., Westfield, Mass.

New York and New Jersey

U. S. INDUSTRIES, INC., New York, City, announces that the Chicago Steel Tank Co., Chicago, Ill., a division of USI has, for administrative purposes, been merged with another USI division—Solar Permanent Co. These divisions will be under the direct supervision of A. STERNBERG, general manager of Solar, who will direct both activities from offices in Chicago and Tomahawk, Wis.

WALES-STRIPPIT CO., Tonawanda, N. Y., has opened its eastern division office at 537 E. Delavan Ave., Buffalo, N. Y., for handling all sales and service to metalworking, electronics, and fabricating plants on the Eastern seaboard. WILLIAM A. SCHROEDER will manage the office.

OLIN MATHIESON CHEMICAL CORPORATION, New York City, has announced the following appointments: DR. W. E. HANFORD has become vice-president for research, and RICHARD M. FURLAND has been named general counsel.

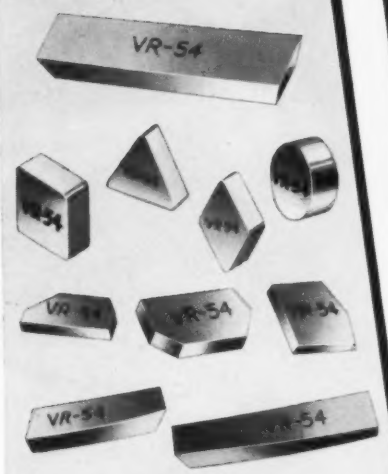
FRANK RANDALL has been appointed president of Amperex Electronic Corporation, Hicksville, N. Y.

BROWN & SHARPE MFG. CO., Providence, R. I., has announced that the new location of its Mid-Atlantic office, which was formerly at 20 Vesey St., New York City, has been moved to 1275 Stuyvesant Ave., Union, N. J.

JOSEPH F. DEGEN has been appointed to the executive group as vice-president in charge of manufacturing for Weston Electrical Instrument Corporation, Newark, N. J., a Daystrom, Inc., subsidiary.

NEW CARBIDE GRADE for MILLING

VR-54



Hardness: 92.0 Rockwell "A"

Transverse Rupture Strength: 325,000 psi.

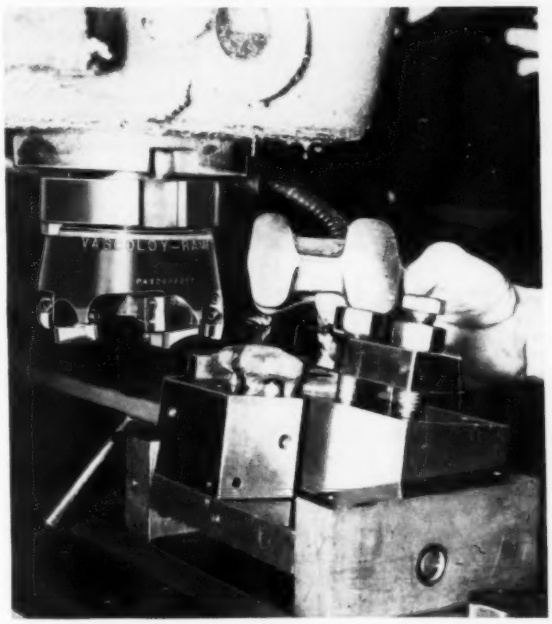
Density 14.50 g. per cc.

NEW VR-54 . . . Outstanding for interrupted cutting of cast iron, chilled cast iron, non-ferrous alloys and non-metallics

This new carbide grade incorporates toughness with high hardness to give the greatest possible resistance to abrasion and shock. These qualities enable VR-54 to outperform other cemented carbides in the removal of metal when milling, broaching, hobbing and rotary burring.

The exceptional uniformity and high quality of this new VR-54 is the result of Vascoloy-Ramet's new and unique process of manufacturing. Typical operations on which VR-54 has proved its superiority are: broaching motor blocks, milling cylinder heads, planing of planer beds, burring stainless steel rings for jet engines, milling ends of motor blocks, burring steel fabricated diesel motor blocks, and in rotary burrs for burring of all types of materials.

For complete information, call your local V-R representative or distributor or write.



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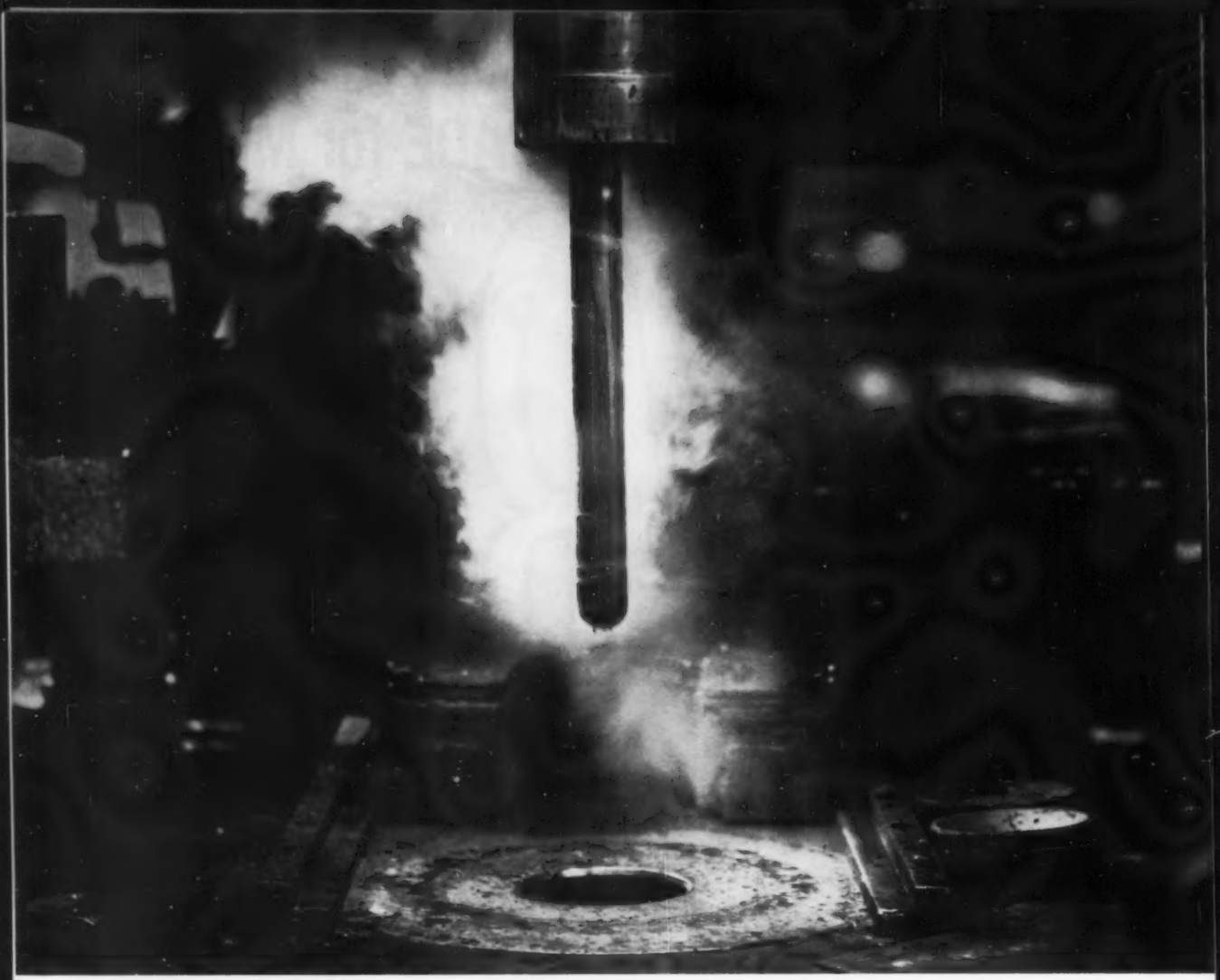

Tough 2½" diameter mandrel at Rc 44 on 1150 ton brass extrusion press. Scovill Manufacturing Co.

Mandrel of HALCOMB 218 retains toughness and hardness at hot work temperatures...

This mandrel is made of Halcomb 218—a tough, air-hardening hot work steel. Halcomb 218 is suitable for tools like this which require a higher degree of toughness at moderately elevated temperatures than is obtainable with the tungsten types of hot work steels. And Halcomb 218 *retains both* its hardness and strength at these temperatures.

For example, at a hardness of Rc 44, Halcomb 218's Charpy Impact Strength is 33 ft-lbs at 500F. And it will retain this hardness after 1 hour, after 10 hours and even after 100 hours at temperatures up to 900F.

Properties like these cut tooling costs. The mandrel shown above is good for 1200 pushes, for example, and even then all it needs, usually, is repolishing before being used again.

Halcomb 218 is particularly useful for all hot work operations on which drastic coolants are used. It even resists breaking very successfully when water cooled in operation. If these sound like advantages you can use, call your local Crucible representative for more complete data. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

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On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

FASTENERS—Judson L. Thomson Mfg. Co., Waltham, Mass. 42-page handbook giving factual grounds for incorporating profitable policies into value analysis, product improvement and cost reduction programs dealing with fasteners. It also includes an evaluation questionnaire which permits users to easily determine which type of fastener to incorporate, and a rivets standards chart. Requests for the Fastener Fact File may be made on company letterheads to Judson L. Thomson Mfg. Co., Waltham 54, Mass.

HIGH-TEMPERATURE ALLOYS—Haynes Stellite Co., Division of Union Carbide & Carbon Corporation, New York City. 28-page properties booklets covering Haynes alloy No. 25 and Hastelloy alloy X. Haynes alloy No. 25, a wrought cobalt-base high-temperature alloy, has been used for many jet-engine applications. In addition, it has given good service in a variety of industrial-furnace applications. Hastelloy alloy X is a nickel-base high-temperature alloy available in both wrought and cast form. It has a high oxidation resistance at temperatures up to 2200 degrees F. Both booklets contain sections on physical properties, short-time tensile data, stress-rupture and creep data, and welding, forming, and machining methods. 1

MILLING MACHINES—Producto Machine Co., Bridgeport, Conn. Three bulletins describing the company's index method milling machines. Bulletin No. 1 gives specification and features of Model HV-44 H.D., a twin horizontal spindle, overhanging-head miller for internal and external slot milling. Bulletin No. 2 describes Model HV-22 arranged for combined horizontal and vertical feed with four-division automatic indexing. Bulletin No. 3 illustrates Model RT-301, a four-division automatically-indexed milling machine that is arranged for horizontal feed. Manual operation of this machine is limited to loading and unloading of the work-piece. 2

MODERNIZING OLD PRESSES—E. W. Bliss Co., Canton, Ohio. 16-page bulletin No. 45, describing modernization and conversion assemblies for older, obsolete, or worn straight-side and gap-frame presses. Includes eighteen examples of how factory-engineered, plant-installed assembly kits add to an older press more working strokes, power-slide adjustments, roller bearings, modern clutches and controls, twin drives for long-stroke work, better die protection, and increased operator safety. Also described are the company's 50-year-old file of press records enabling modernization assemblies to be built quickly at moderate costs. 3

MATERIAL TRANSFER—Fawick Airflex Division, Fawick Corporation, Cleveland, Ohio. 6-page folder ML-177, describing functions and applications of the company's Rotorseals and Quick Release Valves. Rotorseals are used to transmit air, liquid, or gases under pressure or vacuum from a stationary source into a rotating shaft. This bulletin includes full technical data and dimensional data. Quick Release Valves, used to provide quick evacuation of pressurized air from pneumatic systems, are also described in detail. 4

DRILL JIG BUSHINGS—Ex-Cell-O Corporation, Detroit, Mich., 14-page catalogue covering the company's line of ASA and

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Ex-Cell-O standard drill jig bushings. This catalogue includes the company's present supplementary list of aircraft bushings and includes 5/32-inch OD group of press fit bushings with holes possible down to .0152 diameter and a new 1/2-inch length which has been added to the 7/8-inch and 1-inch OD groups of head and headless press fit bushings. 5

UPRIGHT DRILLS—Western Machine Tool Works, Holland, Mich. 8-page catalogue No. 5715, covering the company's heavy-duty upright drills, Models 6-12 B.M. and 6-12 B.M.R. The 6-12 B.M. is a box model rectangular-table machine available in 1, 2, 3, or 4 spindle models with either one adjustable table for all spindles or separate adjustable tables for each spindle on the low-base gang drills. The 5-12 B.M.R. and 6-12 B.M.R. are heavy-duty, round-column, round-table machines. 6

RELIANCE PRODUCTS—Reliance Electric & Engineering Co., Cleveland, Ohio. 12-page Booklet A-2400, discussing the specialized drives and motors engineered and built by the company. Covered are many Reliance "firsts" for shipboard application as well as integral a-c motors to 400 hp, d-c units to 1000 hp, d-c and a-c generators and motor-generator sets, gearmotors and variable-speed drive systems and their control. 7

CORROSION PREVENTIVES—Pennsylvania Refining Co., Butler, Pa. Chart listing of military-specification corrosion preventives for industrial and military use. Presented are data on twenty corrosion preventives, including solvent cutbacks, petrolatum barriers, general-purpose preservatives, and engine-preservation lubricants. Information shown includes physical properties, application, removal, coverage and uses, and also methods of cleaning and preservation. 8

COPPER CORROSION RESISTANCE—American Brass Co., Waterbury, Conn. 32-page booklet B-36R entitled "Corrosion Resistance of Copper and Copper Alloys," incorporating latest findings on the theory of corrosion and types of corrosive attack. Included is a tabulation indicating the relative corrosion resistance of principal types of copper and copper-base alloys when in contact with 186 different corroding agents. 9

WORM GEAR DRIVES—Cone-Drive Gears Division, Michigan Tool Co., Detroit, Mich. 24-page bulletin CD-200, giving extensive technical information on the design and application of double-enveloping worm-gearing. Included are detailed engineering formulae and step-by-step instructions for using them in designing and applying Cone-Drive gearing to drives of all types. Service factors and lubrication information also are included. 10

FILLING AND SEALING MACHINE—Bijur Lubricating Corporation, Rochelle Park, N. J. 4-page bulletin NB-18, describing the company's fully automatic filling and sealing machine, which is capable of filling and sealing plastic tubes at the rate of 120 tubes a minute. Designed for use in pharmaceutical, food packing, and cosmetic industries, the machine's versatility also makes it adaptable for filling and sealing metal tubes, bottles, and jars. 11

OIL-BATH AFTERCLEANER—American Air Filter Co., Inc., Louisville, Ky. 8-page bulletin 285A, describing a redesigned Cycoil oil-bath aftercleaner. It is designed especially for collecting dust particles that might escape dry centrifugals or viscous-impingement filters. The machine is designed for metalworking dust problems such as cast-iron machining, production metallic grinding, and toolroom-equipment grinding. 12

SURFACE FINISH—Micrometrical Mfg. Co., Ann Arbor, Mich. 14-page Profilometer catalogue No. 157, describing the Profilometer line which provides mechanical electronic shops with instruments for measuring surface-roughness height in micro-inches (arithmetical or rms average). The line includes an amplimeter which shows the roughness reading in micro-inches; tracers of various design, which are connected to the amplimeter, and are moved over the surface being measured; and motor-driven piloting equipment for moving the tracer. 13

SEALED GEAR PUMP—Bijur Lubricating Corporation, Rochelle Park, N. J. 2-page technical reference leaflet describing the company's sealed gear pump for mounting on any machine which requires fluid circulation for lubrication or other purposes. Two models of the pump are described: the uni-directional, in which fluid flow reverses when shaft rotation reverses; and the reversible, in which fluid flow is always in the same direction regardless of shaft rotation. 14

INDUSTRIAL HEATING UNITS—Westinghouse Electric Corporation, Pittsburgh, Pa. 24-page booklet 27-620, describing a wide variety of heating units—strip heaters, oven heaters, immersion heaters, bolt heaters, and industrial hot plates. Heating problems and their solutions are discussed with the aid of graphs and charts and a complete line of compatible heater-control equipment is also featured. ..15

HYDRAULIC FLUIDS—Vickers, Inc., Detroit, Mich. 24-page bulletin No. 1300SA "Selection, Operation and Maintenance of Hydraulic Fluids for Industrial Machinery," describing the characteristics of petroleum-base and fire-resistant hydraulic fluids. Tells how to select the best fluid for a given job, how to care for it, and what to do about trouble when it occurs. 16

EXPANDED METAL—Joseph T. Ryerson & Son, Inc., Chicago, Ill. 8-page Bulletin 20-4, describing expanded metal uses in plant construction and maintenance, man-

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ufactured articles, ornamental and display racks, etc. Also gives sizes, air flow tables, and load capacities of the grating type. Expanded metal is supplied in carbon steel, stainless steel, and aluminum in standard and flattened mesh. 17

PRODUCTION EQUIPMENT—National Broach & Machine Co., Detroit, Mich. 24-page catalogue AP57-11, describing the complete line of Red Ring gear-production equipment and broaching tools. Included in the catalogue are a general capacity table and descriptions of rotary shaving machines for internal and external spur and helical gears up to 200-inch capacity. 18

SPEED VARIATORS—General Electric Co., Schenectady, N. Y. 16-page bulletin GEA-6643, describing the company's line of packaged direct-current adjustable-speed drives available from 3 through 150 hp, 220, 440, 550 volts, 3-phase AC 60 cycle. Included is a power unit data slide rule for calculating case dimensions, hp, speed range, power-unit weight, and motor-frame size. 19

ELECTRO-PROBE GAGING—Federal Products Corporation, Providence, R. I. 4-page brochure describing the company's Electro-Probe electronic test indicator, a portable dimensional test instrument; and the Sure-Set, an electronic table-positioning device for universal grinders. All pertinent specifications for both the Electro-Probe test indicator and the Sure-Set are listed in convenient tabular form. 20

HAND SCREW MACHINE—Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. 6-page fold-out bulletin AD-1101, describing the company's hand screw machine which features a bed turret with six stations. Also explained is how the standard Delta 11-inch metal lathe may be converted into a hand screw machine by adding accessories. 21

MILLING MACHINES—Colonial-Romulus Division, Colonial Broach & Machine Company, Detroit, Mich. 4-page bulletin No. CRS-57, describing the company's line of tracer-controlled sculpture machines. These machines can be used for tracer-controlled contour and profile milling in a wide range of metals. Speeds are infinitely variable. 22

SEAMLESS TUBING—Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa. 5-page sales letter No. 290, furnishing detailed information on the high-temperature strength properties of the company's Croloy 16-13-3 (TP316) seamless tubing. Data includes results of short-time tensile and creep rupture tests made at temperatures up to 1500 degrees F. 23

INSTRUMENT AND CONTROL SWITCHES—Allis-Chalmers Mfg. Co., Milwaukee, Wis. 8-page bulletin 14B-8112A, listing construction features of the company's instrument and control switches (Type 210). These are available as either maintained or spring return contact types and are used in conjunction with circuit-breakers, transformer tap changers, motor-operated rheostats, and many other types of electrically controlled apparatus. 24

WELDING SUPPLIES—Air Reduction Sales Co., a division of Air Reduction Co., New York, N. Y. 48-page catalogue Form ADC 848B, describing supplies and accessories for gas and arc welding. Included is information on ferrous and nonferrous welding rods, welding and brazing fluxes and their applications, aluminum welding fluxes, Aircosil silver brazing alloys, brazing alloys, and Jackson and Airco protective equipment. 25

FLO-PILOT VALVES—Hanna Engineering Works, Chicago, Ill. 8-page catalogue describing the company's Flo-Pilot valves, available in five basic models—ball cam, palm button, hand lever, locking hand lever, and mechanical link clevis. These are 1/4-inch pipe size for two- and three-way air operation to 150 psi. They are used for remote control of master valves, directional control of small single-acting cylinders, and for shut-off. 26

BENDING MACHINES—Wallace Supplies Mfg. Co., Chicago, Ill. 34-page booklet describing the three types of bending: rotary, ram, and roll. Booklet was made up mainly to acquaint those people who are not too familiar with the various types of bending and give them an idea of how bent pipe, tubing, and structural shapes are used. 27

BOTTOM DRIVE PRESS—Clearing Machine Corporation, Chicago, Ill. 32-page Catalogue No. 235, describing the company's line of bottom drive mechanical presses and including typical specifications of single-, double-, and triple-action presses as well as a description of the various types of accelerated slide motions available. 28

WET BLAST CLEANING — Pangborn Corporation, Hagerstown, Md. 4-page folder 1403, describing the diversity provided by Pangborn Hydro-Finish, the wet blast cleaning cabinet in which compressed air forces a slurry of water and

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fine abrasive—usually a talc or other lava product—against work to be finished. 29

MECHANICAL GAP PRESSES—A. B. Farquhar Division, the Oliver Corporation, York, Pa. 4-page Bulletin M-100, detailing complete facts on the company's line of open-back-inclinable mechanical gap presses. Their four capacities are described as well as important features and specification details. ...30

CLUTCH CONVERSION—Minster Machine Co., Minster, Ohio. 16-page folder CC57, discussing the features of the company's air-friction clutch and brake for reconditioning and modernizing existing mechanical presses. Reasons why production is increased and maintenance is reduced as a result of clutch conversion are shown. 31

HIGH PRODUCTION PRESSES—Niagara Machine & Tool Works, Buffalo, N. Y. 24-page Bulletin 264, presenting the company's Series SA-2 two-point, straight-side automatic presses complete with advanced automatic coil feed plus the latest press-mounted controls and devices. 32

TUNGSTEN-CARBIDE SURFACING — Kennametal, Inc., Latrobe, Pa. 4-page bulletin describing Kenplate tungsten-carbide surfacing, its uses in protecting metal parts against abrasion and wear, and application methods. Kenplate consists of small hexagonal carbide buttons assembled on a flexible backing material for bonding on metal surfaces. 33

OPTICAL COMPARATORS—Jones & Lamson Machine Co., Springfield, Vt. 36-page catalogue describing the company's precision machines which inspect and measure objects. Subjects covered are how they work, what they do, models, features and specifications, fixtures and accessories. 34

OVERHEAD DOOR INSTALLATION—Barber-Colman Co., Rockford, Ill. 8-page booklet describing overhead door installation which, it is claimed, can pay for itself in less than two years through measurable extra plant-operating economies resulting from reduced heat losses and from time savings. 35

INSTANT-REVERSING MOTORS—Franklin Electric Co., Inc., Bluffton, Ind. 4-page leaflet describing the company's instant-reversing mechanism for electric motors. This device is available with single-phase, 1725-rpm, 115- or 230-volt, sleeve or ball-bearing motors from 1/6- through 1-hp ratings. 36

GAP PRESSES—Verson Allsteel Press Co., Chicago, Ill. 14-page booklet describing the company's gap type presses designed for the small stamping shop or for any manufacturer who must produce a great variety of stampings of all sizes. These presses primarily feature stamping, piercing, forming, and shallow drawing operations. 37

REFINERY EQUIPMENT — Babcock & Wilcox Co., Beaver Falls, Pa. 10-page reprint TR-548 of an article entitled "The Corrosion of Ferrous-Metal Tubing in Refinery Service," and dealing with separate phases of ferrous-metal corrosion in the refinery field. 38

DRILL SLEEVES—James Products Co., Mentor, Ohio. Ring-binder page describing the company's straight-shank, Dupont nylon drill sleeves. Advantages claimed for the nylon drill sleeve over other types are listed. 39

PRECISION GRINDING—Mattison Machine Works, Rockford, Ill. 7-page booklet describing the company's large, high-horsepower surface grinders and their consequent increased scope of grinding operations. 40

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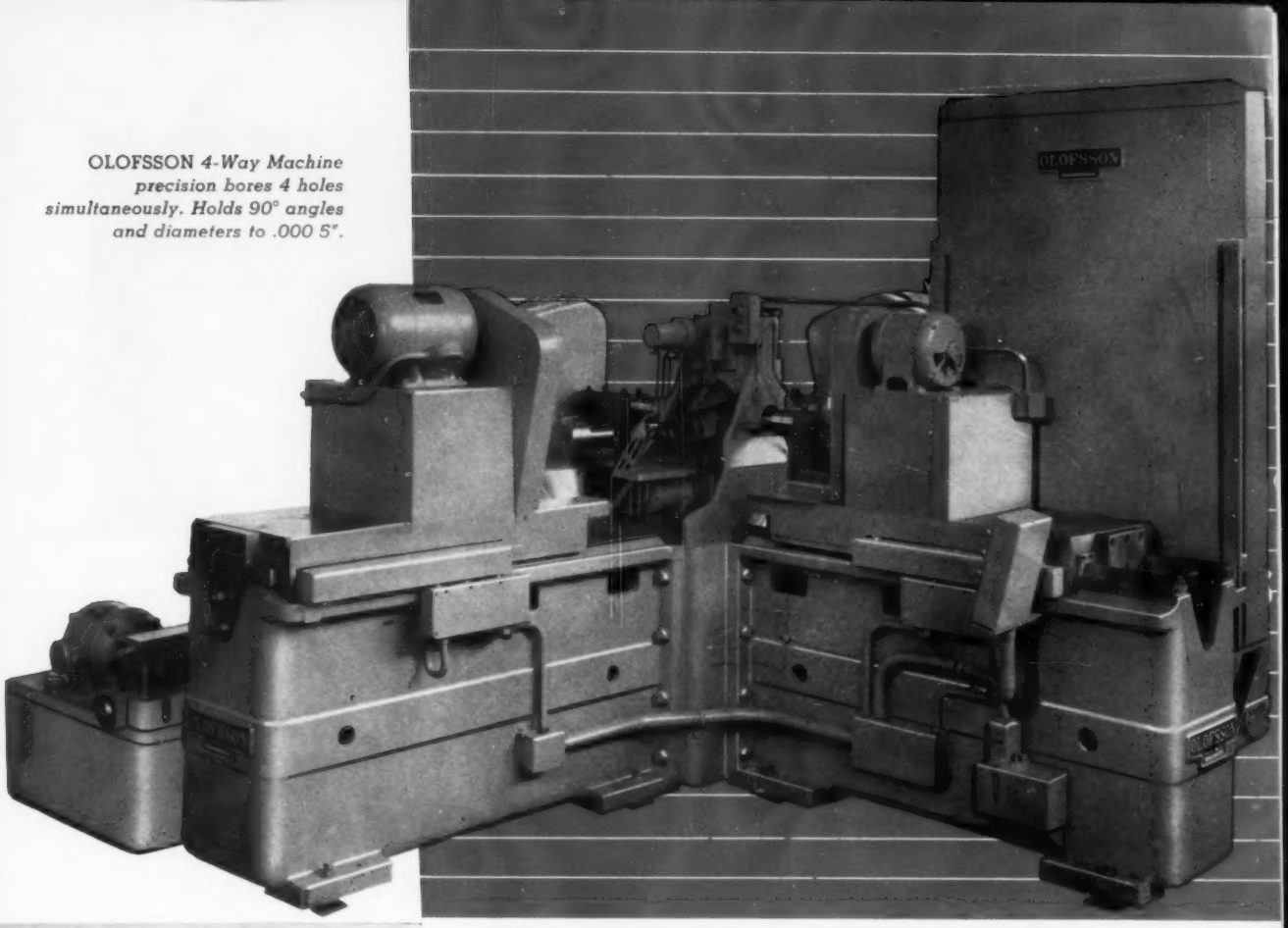

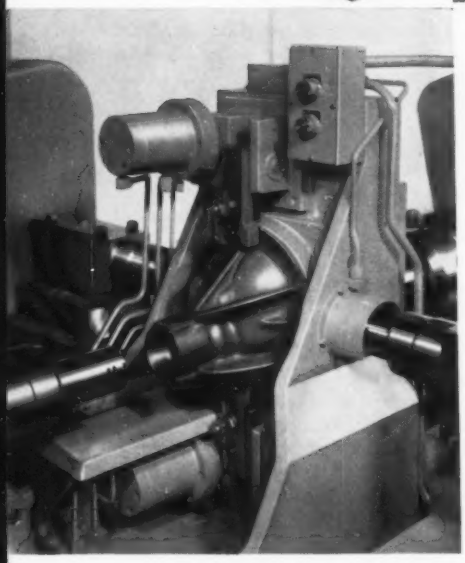

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Ohio and Indiana

E. W. Bliss Co., Canton, Ohio, has announced the appointment of James I. Ashley, sales engineer, Press Division. Mr. Ashley's headquarters will be the company's Southern California sales office, Burbank, Calif. The company has added to its product line a multi-fingered vise which automatically adapts its grip to provide positive holding of irregular-shaped pieces. The vise, which will be continued to be sold by Bliss under its present name, Ampogrip, was acquired from the American Positive Grip Vise Corporation, Willimansett, Mass., by the purchase of patents, trade name, inventory, and tools and fixtures for an undisclosed amount.

Lincoln Electric Co., Cleveland, Ohio, has announced that Paul McGonigle, Richard R. Gould, and Jerry Weiss have recently joined district sales offices at Boston, Mass., Pittsburgh, Pa., and Detroit, Mich., respectively. All three men completed a one-year training program at Lincoln's plant in Cleveland prior to their present assignments.

Lennox Tool & Machine Builders, Lima, Ohio, have expanded their operations to include two proprietary items through their purchase of the complete line of Baker sensitive drilling machines and True-Edge contour shear from Baker Brothers, Inc., Toledo, Ohio. W. V. Trask has been made sales manager for these products and is currently appointing additional dealers to establish nation-wide distribution.

Federal Machine & Welder Co., Warren, Ohio, has elected J. R. Barefoot president, replacing A. S. Blagden, who has been elected to the newly-created post of chairman of the board of directors.

J. R. Barefoot, president, Federal Machine & Welder Co.

Thompson Grinder Co., Springfield, Ohio, has appointed the Southeast Machinery Co., Fort Lauderdale, Fla., exclusive distributor for Thompson grinders in Florida. Also appointed to serve as exclusive distributor in the north Texas area for Thompson grinders is Machine Tool Associates Inc., Dallas, Tex.

Fosdick Machine Tool Co., Cincinnati, Ohio, has appointed Wing & Jabaay, Grand Rapids, Mich., distributor for western Michigan.

John R. Keates, general sales manager, Machine Tool Division, National Automatic Tool Co., Inc.

John R. Keates has been appointed general sales manager of the Machine Tool Division of National Automatic Tool Co., Inc., Richmond, Ind.

Pennsylvania and Washington, D. C.

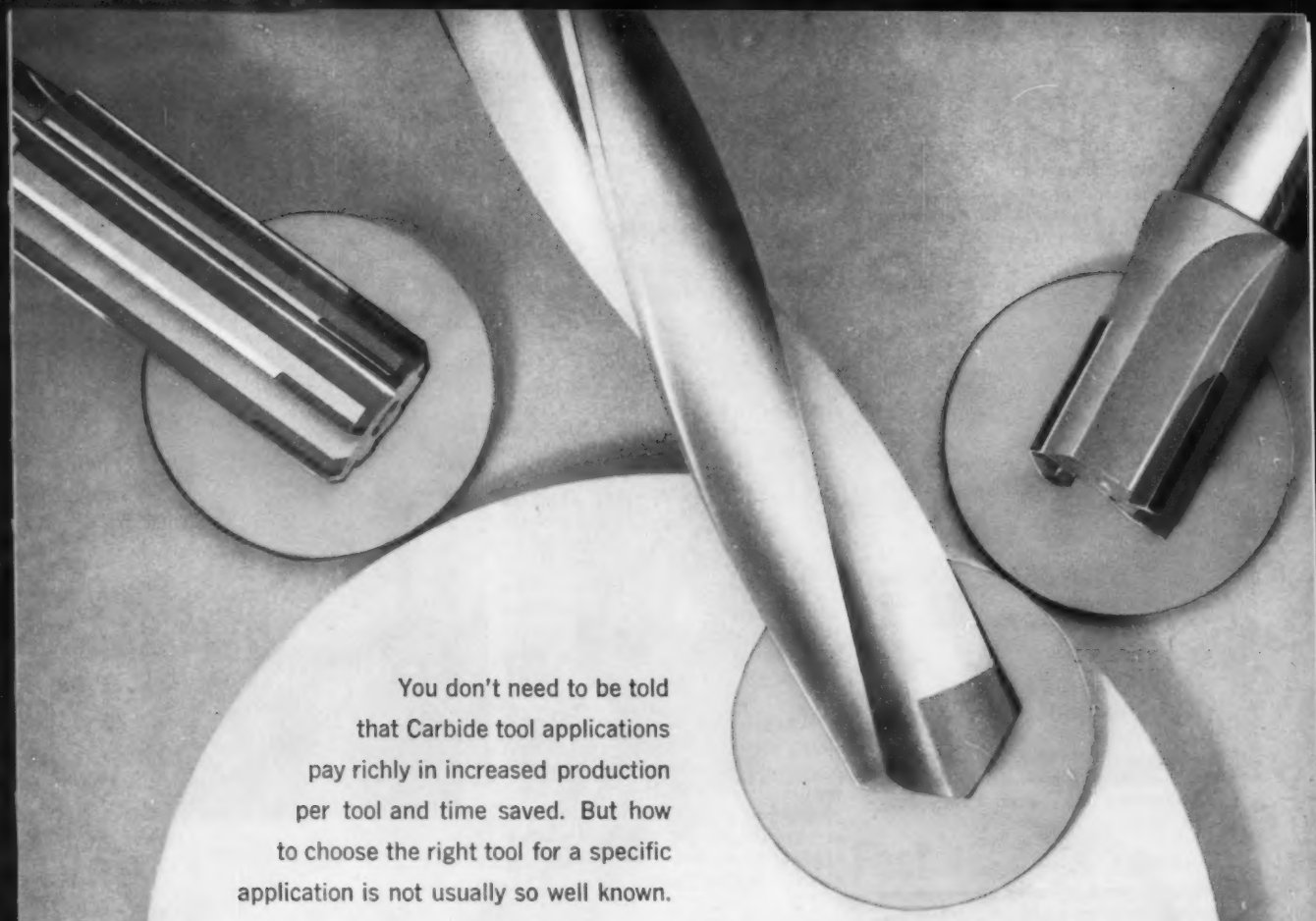
William K. Stamets Co., with main offices in Pittsburgh and a branch office in Cleveland, announces the election of W. J. Smetak as president, treasurer, and general manager of the company and its subsidiary, Stamets Export Co. Henry R. Hanson has been elected vice-president and general manager of the distributor division which is comprised of the Pittsburgh and Cleveland machine tool sales offices. A. H. Long has been elected vice-president of engineering.

William J. Thomas, vice-president, Tubular Products Division, Babcock & Wilcox Co.

William J. Thomas, vice-president and general manager of Tubular Products Division, Babcock & Wilcox Co., Beaver Falls, Pa., has been elected to the board of directors of the company and placed in full charge of the division. Mr. Thomas' new position fills the vacancy created by the resignation of Edward A. Livingstone.

Carpenter Steel Co., Reading, Pa., announces the acquisition of Northeastern Steel Corporation, Bridgeport, Conn. Frank R. Palmer, president of Carpenter Steel, has been named president of Northeastern. Seven other officers also were named to head up the new subsidiary, now officially known as Carpenter Steel of New England, Inc. They are John Moxon, executive vice-president; Arlington A. Britton, Jr., vice-president of production; H. Sturgis Potter, vice-president of sales; Dr. Carl B. Post, vice-president and technical director; Willard E. Roberts, secretary and treasurer; Oliver May, assistant treasurer and assistant secretary; and William Bouton, controller. All except May and Bouton hold similar positions with the parent firm. Four men have been appointed to staff positions in the metallurgical and operating departments of the new company—Walter L. Schlegel, resident chief metallurgist; Elmer Schwartz, general superintendent, production departments; James McMinn, superintendent of billet preparation; and Joseph J. Barrett, assistant superintendent of hot rolling.

(This section continued on page 234)



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CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa., has announced the appointment of KENNETH A. MATTICKS to the newly created position of manager of product development, Stainless Steel Sales Division. He will continue to maintain offices at Crucible's headquarters in Pittsburgh and will direct activities designed to promote the development of new or improved stainless steel products. Mr. Matticks will also have responsibility for technical and other services to the company's stainless steel customers.

LATROBE STEEL CO., Latrobe, Pa., has appointed J. E. WORKMAN executive vice-president. HOWARD M. GIVENS has been named vice-president of sales and W. G. DAHL has been appointed general sales manager.

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa., manufacturer of forging equipment, has announced that its products will be sold in the state of Florida through SOUTHEAST MACHINERY CO., Fort Lauderdale, Fla.

FRANK L. BRUGGER has been appointed product sales manager for metal cutting tools, KENNAMETAL INC., Latrobe, Pa.

NIELS A. OLSEN, Kimberly, Idaho, has been named director of the Metalworking Equipment Division, Business & Defense Services Administration, United States Department of Commerce, Washington, D. C.

Texas, Louisiana, and Alabama

AIR REDUCTION SALES CO., A Division of Air Reduction Co., Inc., New York City, has recently completed a $400,000 gas-producing plant at Arlington, Tex. The plant is primarily designed to produce high-purity oxygen and nitrogen, and also contains centralized stores and warehouse facilities for other major products of the company. In addition, warehouse and office facilities have been built at the location for Air Reduction's Ohio Chemical & Surgical Equipment Co. Division, producers of medical gases and hospital supplies and equipment. C. T. BURGGRAF is district manager of the new plant and HARRY MELICK, who until the move had been in charge of the Dallas, Tex., plant, has been appointed superintendent.

SIMONDS SAW & STEEL CO., Fitchburg, Mass., announces the opening of a new southern branch in Shreveport, La. The new branch has been planned as a distribution, sales, and service center for the surrounding nine-state area and includes a 40,000 square foot building.

SOUTHERN FABRICATING CO., INC., Sheffield, Ala., has opened a new tube division in that city.

° ° °

One giant aircraft in production in the United States requires the use of 114 electric motors (exclusive of the automatic pilot).

Niels A. Olsen, center, receiving congratulations from BDSA administrator H. B. McCoy, and Swan E. Bergstrom, executive vice-president, Cincinnati Milling Machine Co.

Obituaries

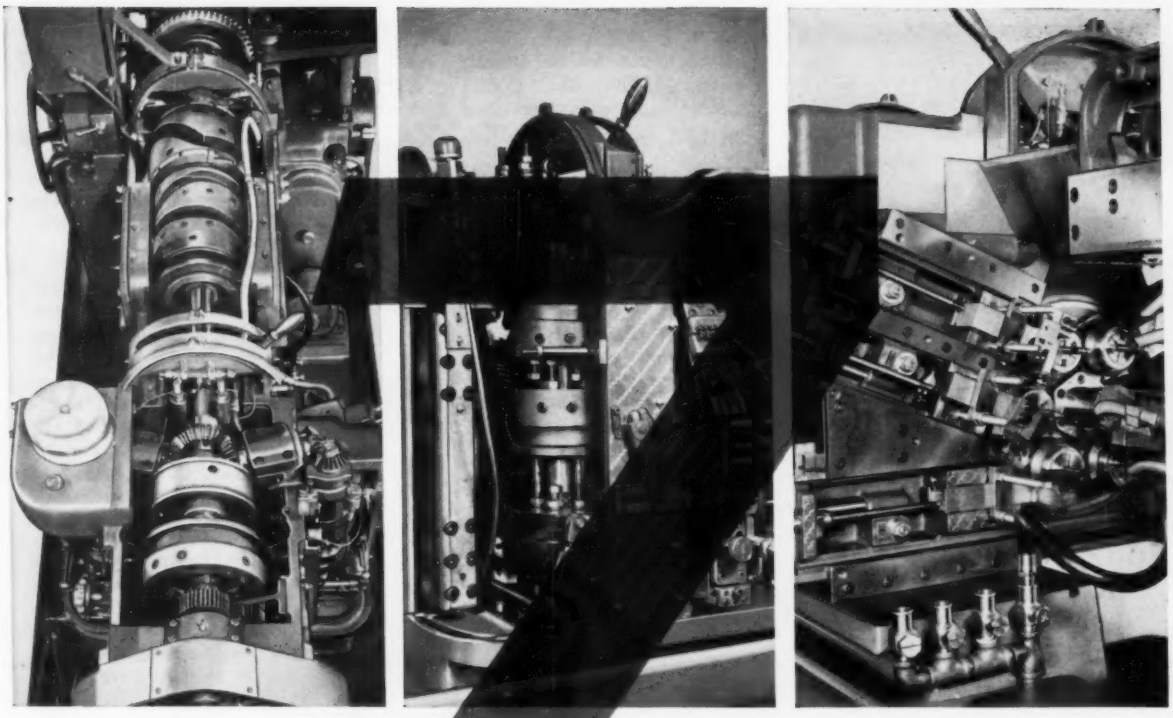
William Kerr Stamets

William Kerr Stamets, president and founder of the William K. Stamets Co. of Pittsburgh and Cleveland, and of the Enterprise Co., Columbiana, Ohio, died November 17 at the age of seventy-four. Mr. Stamets was prominent in Pittsburgh and Cleveland industrial circles and nationally recognized in the machine-tool and pipe-mill industries. In 1912 he founded the William K. Stamets Co. and until his death was president and chairman of the board of this firm, of the Enterprise Co., and of the Stamets Export Co. of Pittsburgh. He was a past president of the American Machine Tool Distributors' Association.

William Kerr Stamets

Thorsten Y. Olsen

Thorsten Y. Olsen, chairman of the board of Tinius Olsen Testing Machine Co., Willow Grove, Pa., died December 10 at the age of seventy-eight years. He had been connected since 1903 with the firm founded by his father, Tinius Olsen, in 1879. He was named president and treasurer of the company in 1929 and relinquished the presidency to his son, Tinius Olsen II, in 1955, remaining chairman of the board until his death. In recognition of his contributions to the advancement of technical training in Norway, his father's native land, he was made a Knight of the Order of St. Olaf by the late King Haakon in 1935. Widely known throughout the metals industry, Mr. Olsen was an active member of the



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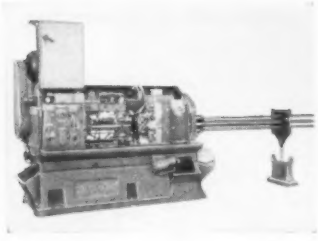
With the prospects of improved tool materials ever decreasing the actual machining time of work on Multiple Spindle Automatics, long runs tend to become short runs. Facility that decreases the time for job changes becomes more important to low-cost production.

Conomatics are available in as many as seven fast changeover models. These are the 9/16", 1", 1 5/8" Sixes, and the 2 5/8", 3 1/2", 5", and 5 1/4" Fours.

These models are equipped with dial adjustment of working stroke of all slides, without making necessary change of total stroke or positive stop settings. Write, wire, or phone for literature descriptive of these features and other facilities available to users, or prospective users.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

American Society for Metals, the American Society for Testing Materials, and the Society of Automotive Engineers. He is survived by a son and five daughters.

F. E. L. WHITESELL, who directed sales activities for the Burndy Corporation, Norwalk, Conn., for twenty years, died December 2 at his home in Winter Park, Fla.

New Engineering Center in New York City

Plans have been announced for a new $10,000,000 engineering center to be erected on United Nations Plaza between 47th and 48th Sts., New York City. A new building will serve as the headquarters of sixteen national engineering societies with a total membership of about 250,000 engineers.

The new center, scheduled for occupancy in the fall of 1960, will replace the present Engineering Societies Building at 29 W. 39th St. in the same city, which is now inadequate in view of the tremendous growth of technology since the building was first occupied fifty years ago.

According to a recent survey, the use of solid tungsten-carbide, rotary cutting tools has increased by more than 500 per cent in the past three years. The end-mills, twist drills, milling cutters, counterbores, countersinks, wood planers, wood routers, and profile cutters here illustrated are examples of preformed solid tungsten-carbide tools on which the finishing operations must still be performed. The survey, which was conducted by the Carmet Division of Allegheny Ludlum Steel Co., Ferndale, Mich., has indicated that economically the size range for solid preformed carbide tools is apparently in the 3/16- to 3/4-inch diameter range. On tools less than 3/16 inch in diameter, it is less costly to grind the flutes from the solid; and on tools larger than 3/4 inch in diameter, most manufacturers use the conventional tipping method.

Coming Events

JANUARY 13-17—Annual meeting and display of the Society of Automotive Engineers has been announced. It will be held at the Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

JANUARY 27-30—Plant Maintenance and Engineering show, which returns to Chicago for the first time in three years, will be held in the International Amphitheater. The Annual Plant Maintenance and Engineering Conference is also set there for the same week. For further information contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

APRIL 14-17—Design Engineering Show and American Society of Mechanical Engineers' Design Engineering Conference will be held in the International Amphitheater, Chicago, Ill. For further information contact Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

APRIL 15-17—The American Welding Society will hold the sixth in the series of annual Welding Shows at Kiel Auditorium, St. Louis, Mo. The same week the Society will hold its annual technical meeting at the Hotel Statler, and an informal welding conference will also be conducted. Further information may be obtained by writing to Robert T. Kenworthy, A. W. S. Welding Show, 12 E. 41st St., New York 17, N. Y.

MAY 1-8—American Society of Tool Engineers' 1958 Tool Show and twenty-sixth annual convention will be held in Conventional Hall Center, Philadelphia, Pa. For further information contact the Exposition Committee of the American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.

MAY 12-16—Southwestern Metal Exposition and Congress, sponsored by the American Society for Metals, will be held at State Fair Park, Dallas, Tex. For further information contact the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. W. H. Eisenman, managing director.

JUNE 9-13—Fourth International Automation Exposition and Congress will be held in the Coliseum, New York City. For further information contact Richard Rumbach Associates, 845 Ridge Ave., Pittsburgh 12, Pa.

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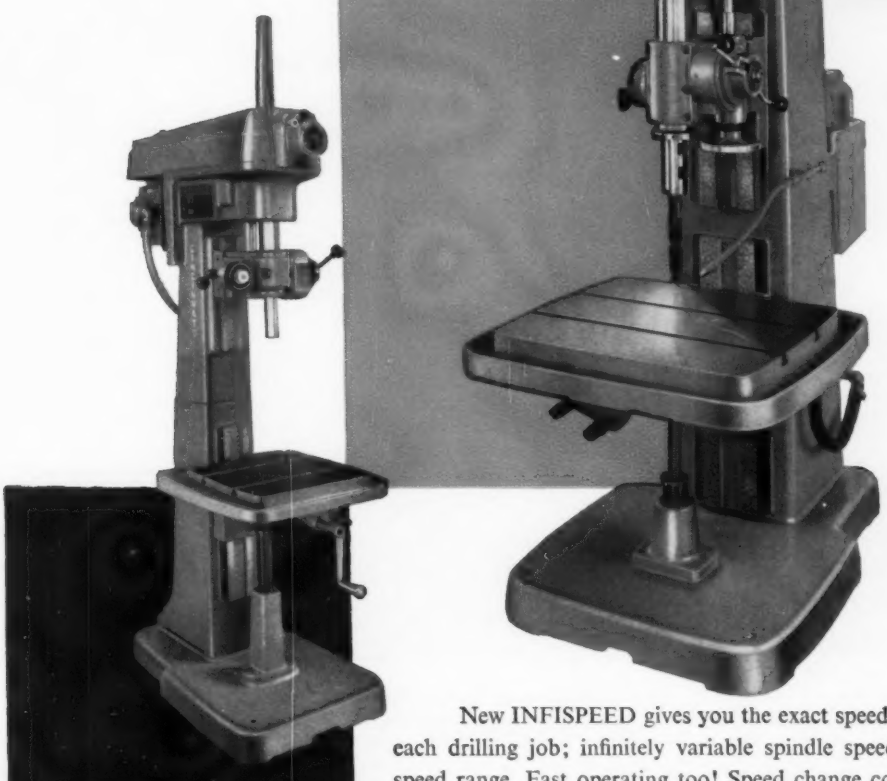

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New Books and Publications

ENGINEERED WORK MEASUREMENT. By Delmar W. Karger and Franklin H. Bayha. 635 pages, 6 by 9 inches; 120 illustrations, tables, graphs, and official MTM data card insert. Published by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $12.

The increasing use of work-measurement systems by scientific managements both here and abroad has emphasized the need for a comprehensive text on this important work-study function of industrial engineering.

Engineered Work Measurement is the first really complete up-to-date text on Methods-Time Measurement to appear in a decade. Not only does it provide a thoroughgoing exposition of the principles, data, and techniques of MTM, but also it coordinates this internationally recognized and outstanding predetermined times system with the well-established techniques of time-and-motion study and shows how these are really interrelated and complementary rather than opposing systems.

Starting with the background and history of work measurement, the book devotes fourteen chapters to the fundamentals of MTM. Every term is defined and illustrated and special MTM mathematics, standards, applications, and the organization and development of MTM training courses are covered in detail. A special feature is the chapter on simplified MTM which should be especially valuable for the design engineer, tool engineer, foreman, or anyone who wants to determine exactly which of several work methods is most efficient for performing a given operation.

Several chapters present a thorough survey of time-and-motion study as used to measure process and cycle times; and the background uses, and the latest and best in accessory equipment, techniques, and time-study forms are described and illustrated.

The following titles of its thirty-two chapters indicate the scope and thoroughness of the book: Origins—a Brief History of Scientific Management and Work Measurement; Orientation—Human Factors in Modern Business; Predetermined Time Systems – Development and Comparison; Methods-Time Measurement—A New Approach; The Methods-Time Measurement Association for Standards and Research; Basic Concepts and Performance Rating; Reach; Move; Turn; Crank; Apply Pressure; Grasp; Release; Position; Disengage; Eye Motions and Allied Topics; Body, Leg, and Foot Motions; Motion Combinations; Motion Patterns—Method Evidence; Simplified MTM Data; Fundamentals of Time Study Observations; Analysis Procedures and Techniques; Allowances and Variances—Adjustment of Standards; Mathematics in Work Measurement; Control of Labor Costs Based on Standards; Fundamentals of Motion Economy; Standard Data and Time Formulas; Application Areas for Work Measurement Techniques; Installing MTM; MTM Training Courses; Organizational Aspects of Work Measurement; Management of Methods and Labor Control.

Since the book covers both MTM and time-and-motion study the reader can judge the distinct areas of application as well as the many situations which demand their combined approach. The practicing engineer will find this book a valuable working reference; the student will find it to be a thorough text that will facilitate his understanding of work measurement as a powerful management tool for determining labor standards and establishing improved manufacturing methods.

PRACTICAL AUTOMATION. By Lester R. Bittel, Morley G. Melden, and Robert S. Rice. 376 pages, numerous photographs and charts. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $7.50.

This book explains and illustrates the fundamental methods and thinking essential to planning and setting up for effective automation. In addition, it gives many examples of successful installations from plants of all sizes in various industries and demonstrates actual applications and methods.

Some of the topics covered are: automatic handling, processing, installation, and communication; special problems relating to electrical, hydraulic, and other systems; essential techniques, equipment, and materials for automation; how to combine machines and equipment already in the shop; how to solve problems likely to be met in installing automation; where to look for possibilities of applying feedback control; and how to solve new maintenance problems.

ENGINEERING METALLURGY. By The Committee on Metallurgy, a collaborative writing group of metallurgy professors. 516 pages, numerous charts and photographs. Published by Pitman Publishing Corporation, 2 W. 45th St., New York 36, N. Y. Price, $7.50.

This Publication was developed to present the principles of ferrous and non-ferrous metallurgy for all engineers—student and practicing. The emphasis throughout is on metallurgical principles rather than on handbook information; however, specific data are given so as to provide a realistic structure to reinforce the theoretical presentations. The practicing engineer who has had little contact with the field of metallurgy, or who has had no formal work in metallurgy, will find in this book a sufficiently complete summary of all of the essentials he needs to know to obtain a broad understanding of the field.

All technical terms are defined as they are introduced, and stress is laid upon fundamental concepts. At the end of each chapter there is a set of questions and exercises constructed to help the student focus attention on the important definitions and principles presented in the chapter.

MECHANIZED WORK-HANDLING ON THE MACHINE-TOOL. (No. 42 in the Yellow Back Series). 68 pages, 5 1/2 by 8 1/2 inches. Published by Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, 75 cents.

In this book are given examples for a wide range of machines and work-pieces that were demonstrated during a machine tool show at Olympia, London. These descriptions will be of practical use to production engineers, students, and others.

MACHINE MOUNTING SPECIFICATIONS FOR ABRASIVE DISCS AND PLATE-MOUNTED WHEELS. ASA B5.35-1957. 21 pages, 8 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.50.

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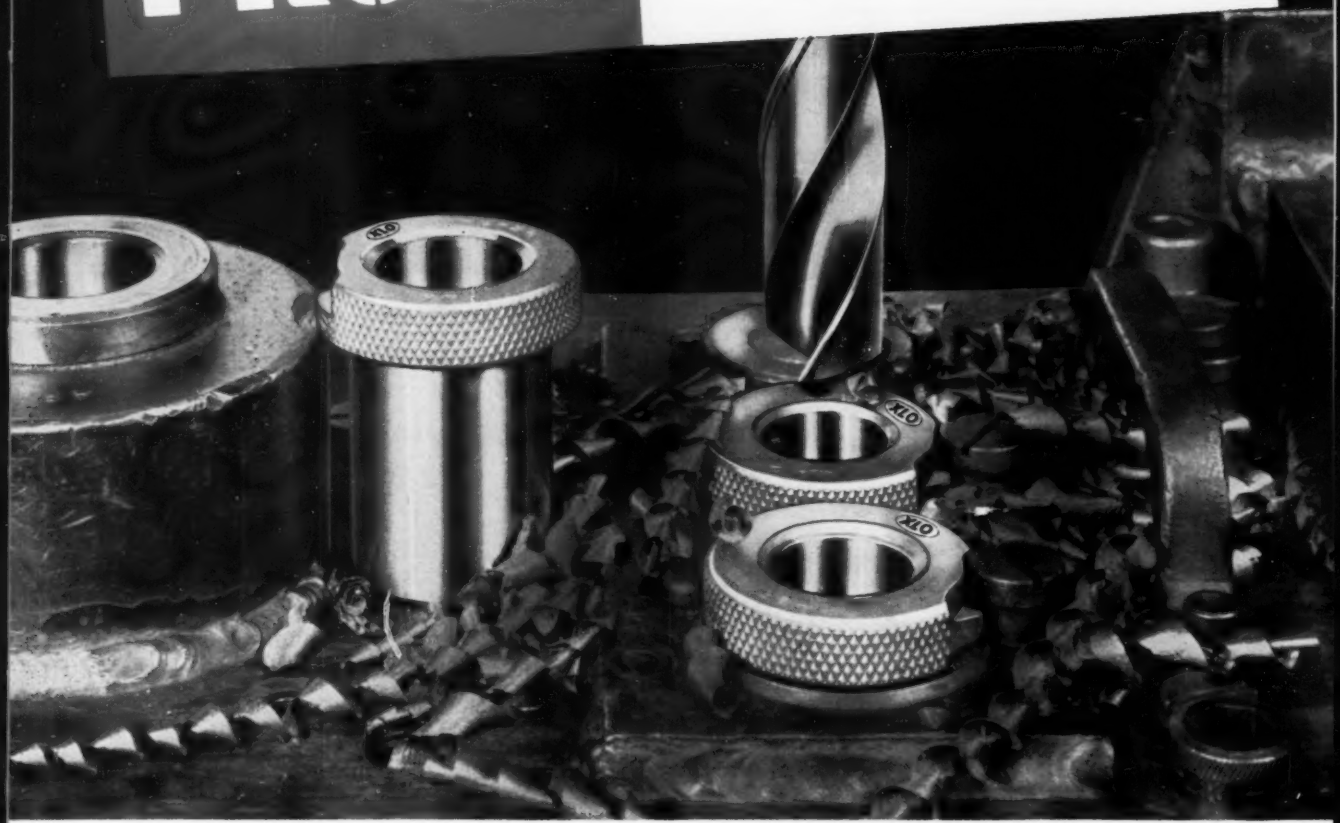

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Product Directory

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Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
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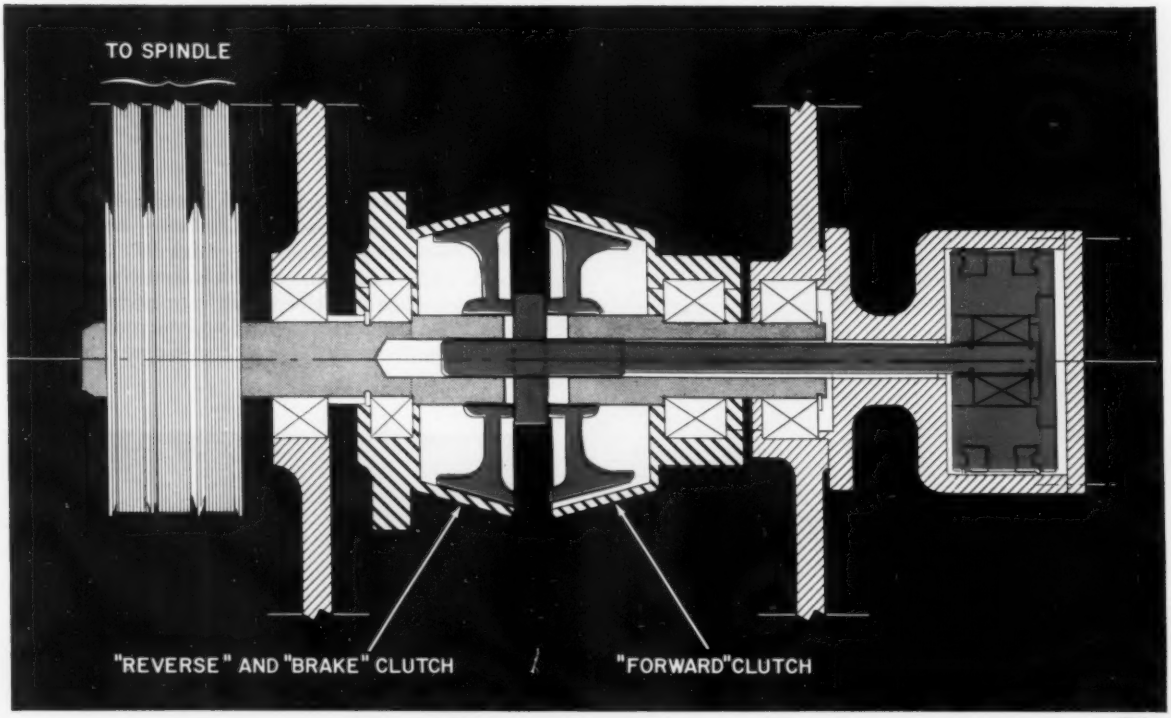
NOW: A Spindle Reversing Clutch That Never Needs Adjustment! Requires No Warm-Up Period!



57-4

Can you think of *any* other screw machine that offers these important cost saving features . . . ?

ACCURACY: Reversing point repeats within ¼ spindle revolution. Even taper pipe threading becomes an ordinary operation with the new Screwmatic 750.

RELIABILITY: Wear will not affect clutch tension or reversing point accuracy.

SIMPLICITY: Constant air pressure of piston acts directly on clutch. No adjusting is ever required.

RUGGEDNESS: Roughly 1000 pounds pressure is applied to clutch cones to insure positive spindle drive.

VERSATILITY: Select most efficient time cycle—spindle will reverse at same point regardless of time cycle gears selected—no high-to-low speed ratio limitations.

ECONOMY: In many cases this new Screwmatic reversing spindle has eliminated the need for left-hand tooling entirely.

AN IMPORTANT NOTE TO PRESENT OWNERS OF A DETROIT SCREWMATIC 750: Because of the 750's exclusive unit construction design which allows piecemeal replacement of entire assemblies, the new Screwmatic spindle reversing clutch described here can be easily and economically installed on *any* Screwmatic 750.

SEND FOR MORE INFORMATION: on how the unique Detroit Screwmatic 750 can cut your production costs—send for your free copy of the new 16-page Screwmatic 750 catalog.

THE GEAR GRINDING MACHINE CO.
3921 Christopher • Detroit 11, Michigan
MANUFACTURERS OF:
FULLY AUTOMATIC GEAR GRINDING MACHINES
RZEPPA ("SHEPPA") CONSTANT VELOCITY UNIVERSAL JOINTS

For more information fill in page number on Inquiry Card, on page 227

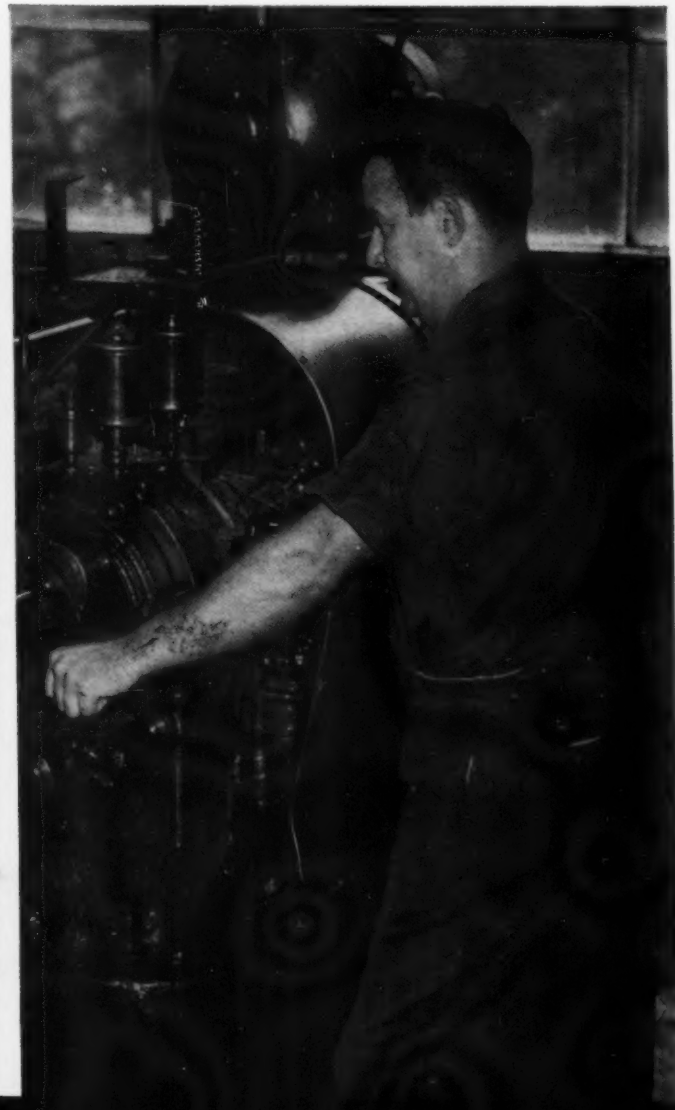
They cut out three oils by changing to one...

Standard Oil lubrication specialist Bob Cleland and plant manager I. G. Smallegan inspect work furnished by operator Dick Stockwell. Giving technical help to customers like this is something for which Bob Cleland is well fitted. Bob has a mechanical engineering degree from Michigan State and has completed the Standard Oil Sales Engineering School.

STANICUT Oil 166 BC

Screw machine plant saves on oil inventory and handling, receives other benefits by converting to dual-purpose cutting oil.

Grand Rapids Metal Products Company's problem was the mixing of cutting and lubricating oils in their National Acme and Gridley screw machines. In all, four oils were used. In some machines a cutting oil, two lubricating oils and a base oil were employed to improve machining characteristics. Lubricating oil leaking past seals mixed with the cutting oil, reducing cutting oil qualities. Oil mixtures were constantly varying, and troubles in tapping resulted.



Standard Oil's Bob Cleland, working with plant management, suggested STANICUT Oil 166 BC. This oil, he explained, is a dual-purpose oil. It can be used for lubrication as well as for cutting, and no dilution of the cutting oil can occur.

After a week's trial in one machine, the entire plant was converted to STANICUT Oil 166 BC. Tap troubles were reduced, resulting in much less down time. Spindle speeds have been increased, yet the spindles run cool. Oil inventories have been reduced from four to one.

STANICUT Oil 166 BC does not corrode bearings, gears, bushings, spindles or other machine parts. While STANICUT Oil 166 BC contains E.P. additives, it does not stain copper or brass.

Get the facts on how STANICUT Oil 166 BC can help you. Call the Standard Oil office nearest you anywhere in 15 Midwest and Rocky Mountain states. Or write to Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

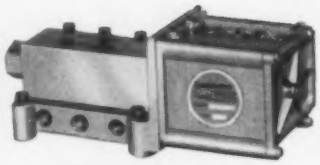
Quick facts about
STANICUT OIL 166 BC

1	A dual-purpose oil — suitable for both cutting and lubrication.
2	Non-corrosive to work or machines.
3	Formulated with E.P. additives.
4	Stable under all normal conditions.
5	Non-irritating.
6	A cutting oil that permits high operating speeds.
7	Non-staining to either copper or brass.

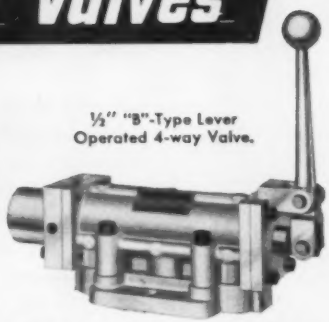
STANDARD

STANDARD OIL COMPANY
(Indiana)

Quick-As-Wink®
AIR AND HYDRAULIC
Control Valves



¼" "O"-Type Single Solenoid 4-way Valve.



½" "B"-Type Lever Operated 4-way Valve.

Play safe. Install Quick-As-Wink valves on **all** your air and hydraulic controls. Positive and fast acting, all operating parts are in pressure balance, avoiding any tendency to creep or crawl. You'll get month after month and year after year of long, dependable, trouble-free — **and safe** — service. There's nothing better than a Quick-As-Wink Control Valve. Can you afford to gamble with less? Sizes from ¼" to 4". Hand, foot, cam, pilot, diaphragm or solenoid operated. Thousands of different types, sizes and actions. Get full details.

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Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
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Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

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Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio
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BEARINGS, Needle
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio

BEARINGS, Oilless
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

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Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
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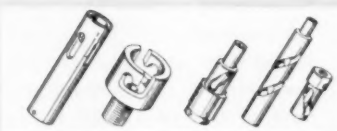
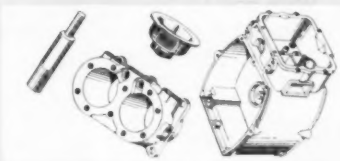
COCHRANE-BLY: Metal Sawing Machines for CUTTING ferrous and non-ferrous materials in regular or irregular shapes up to 20" in diameter.



TAYLOR and FENN, Machine Division: Machines for MILLING a full variety of straight and spiral keyways.



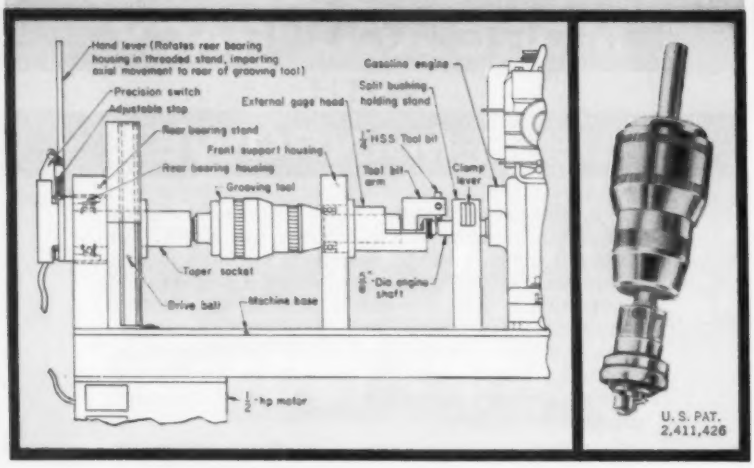
THE CLEVELAND TAPPING MACHINE CO.: Standard and Special Machines for drilling and TAPPING . . . incorporating rotary index tables.

THE TOWNSEND MFG. CO.: Hopper Fed Secondary Operation Machines for TURNING, drilling, pointing, grooving of headed blanks.

The H. P. TOWNSEND MANUFACTURING CO.

BROOK ST., WEST HARTFORD 10, CONNECTICUT

Groove cut in shaft of fully assembled engine with WALDES TRUARC GROOVING TOOL



To install a small gear, Clemson Bros. must machine a recess (Tolerance: +.033" —.000") in a shaft of the engine for their power lawn mowers.

Engines arrive fully assembled. Normal procedure was to rotate the shaft. That involved removing a spark plug, mounting each engine firmly and accurately on a lathe, securing a gear or sprocket on the shaft, driving the shaft and moving the stationary cutting tool into position. The engine had to be reassembled after grooving.

All this costly time and labor was eliminated by holding the shaft stationary and *using a tool that rotates*—the Waldes Truarc Grooving Tool, equipped with an external grooving attachment. Because grooving dimensions are pre-set on the tool, there are no rejects caused by inaccurate cutting.

No recessing problem is too tough for this amazingly versatile tool. It's so simple, even unskilled labor can use it accurately...so cost-saving, it often pays for itself on a single small run!

Write now for 20-page manual containing full information on Waldes Truarc Grooving Tool.MO10

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47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

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Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
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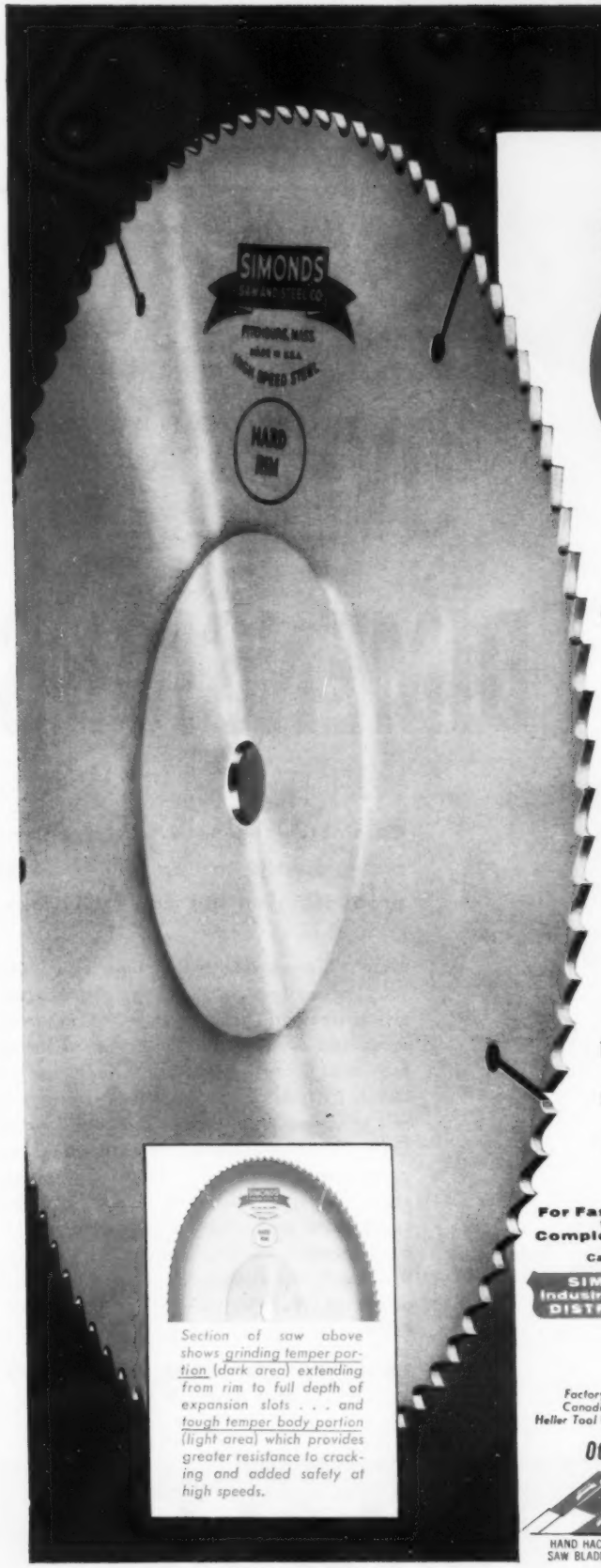
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.

(Continued on page 249)

NEW!



Section of saw above shows grinding temper portion (dark area) extending from rim to full depth of expansion slots . . . and tough temper body portion (light area) which provides greater resistance to cracking and added safety at high speeds.

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- **Longer Cutting Life**
- **Maximum Safety**
- **Minimum Kerf**

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Simonds "Hard Rims" will produce a better finish because the solid tooth design cuts truer . . . you can safely run 'em at higher speeds because they will not shatter. And they can repeatedly be resharpened on standard saw grinding equipment. When you get yourself a Simonds "Hard Rim" (8″ to 18″ dia.), you've got yourself a SAW, brother!

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SIMONDS Industrial Supply DISTRIBUTOR

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The FEDERAL "55" gives you OVERSIZE DIMENSIONS

Eliminates the need for larger and more costly equipment! Boosts production on big and bulky jobs!

Here's a press that will handle big, bulky jobs ordinarily requiring larger, more expensive equipment. The new Federal "55" is setting speed and economy records for many manufacturers. When equipped with foolproof air clutch, its speed is increased many times normal operation, safely and with better control. Only the finest components are used in the manufacture of the "55." Timken bearings, solid, web-type V-ways and gibs, oversize crankshafts. Hydraulic recline mechanism is front-operated. Workmanship, as in all Federal Presses, is unexcelled. Available in flywheel or geared types. Mechanical clutch standard. Call your dealer. Write today for catalog.

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Also available: No. 44—35-ton capacity
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Lovejoy Tool Co., Inc., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridgeport 6, Conn.
Canton Tool Mfg. Co., E. Canton, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford ,Ill.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
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Pope Machinery Co., Haverhill, Mass.
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Wales-Strippit Co., Akron, N. Y.

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Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., 450 Fair Ave., Ferndale, Detroit 20, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti, Milan, Italy.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Morey Machine Co., 383 Lafayette St., New York 3, N. Y.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridegport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

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Bullard Co., 286 Canfield Ave., Bridegport 6, Conn.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 2, Pa.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road., Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegon, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7412 S. Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridegport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BROACHING MACHINE, Internal

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

BURNISHING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel

Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal

Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool
Standard Pressed Steel Co., Jenkintown, Pa.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPER, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Pa.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron 35, Mich.
Pittsburgh Brass Mfg. Co., 3199 Penn Ave., Pittsburgh 1, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Grey Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Crucible Steel Co of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

CEMENT, Abrasive Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTER-DRILLING MACHINES
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Improved Machinery, Inc., Nashua, N. H.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES — See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

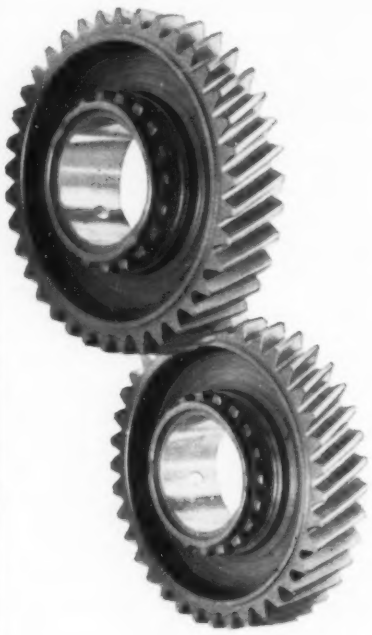
CHUCKING MACHINES, Multiple-Spindle Automatic
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Morey Machine Co., 383 Lafayette St., New York 3, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter and Johnston Co., 1027 Newport Ave., Pawtucket R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

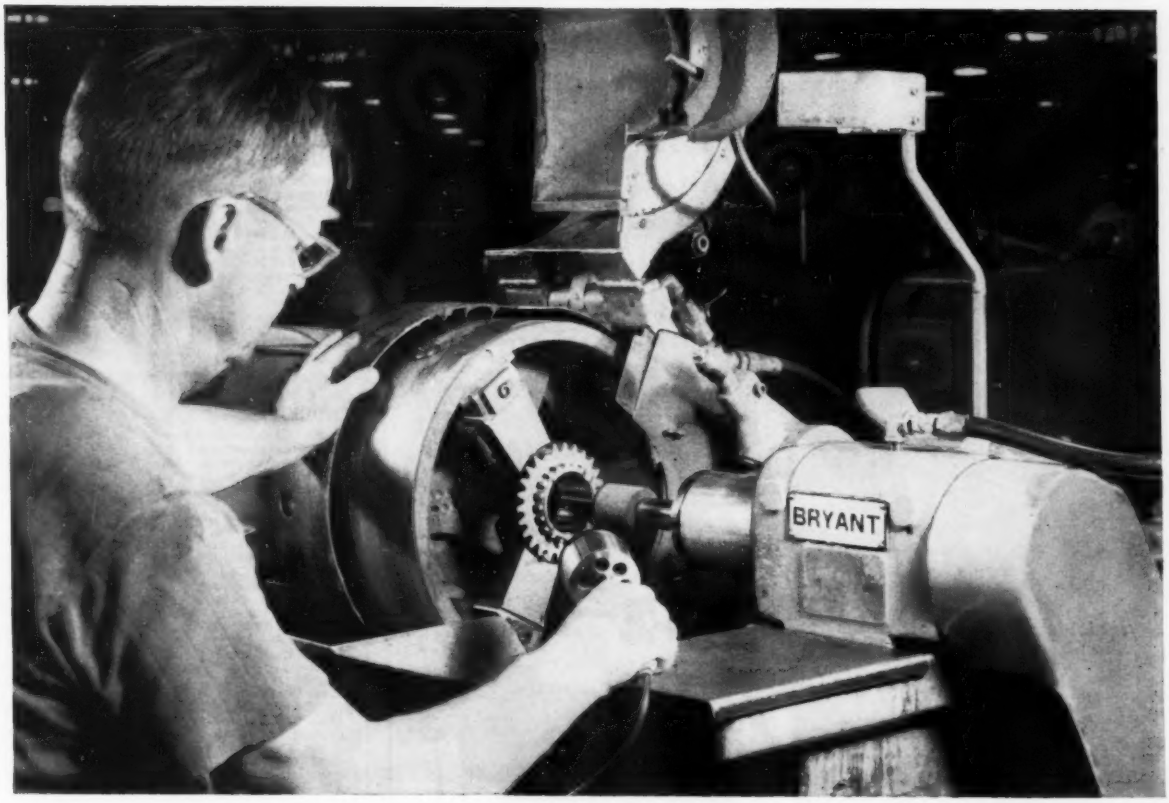
(*Continued on page 252*)

Meet BERNARD C. DAY

... one of Bryant's internal grinding experts, who helps solve grinding problems for customers throughout the Cleveland territory. Mr. Day can be reached at Center West Bldg., No. 307, 20950 Center Ridge Road, Cleveland 16, Ohio. Tel. Edison 1-9626.

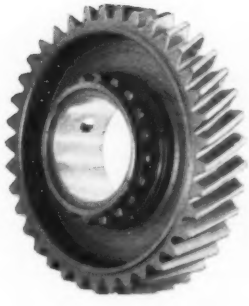


Gears like these, ground on a Bryant 3216, are typical of the precision items made by Dana Corp.



Q. Why does Dana Corp., Toledo, Ohio, use eight Bryant 3216 Internal Grinders?

A. "The Bryant 3216 produces more parts for less money . . . gives better quality than manually operated machines . . . holds size consistently and finishes better."



The Toledo Division of Dana Corp., specializes in making a great variety of parts: transmissions, universal joints, propeller shafts, forgings, gear boxes and torque converters, to name only a few.

In the words of a company official, Dana is "a sort of glorified jobbing shop . . . our runs are comparatively short, and quick changeover ability is a key factor in our operation."

At Dana, the Bryant 3216 Automatic Internal Grinder has proven superior to other makes. The company first bought four 3216's, and then, because of their excellent performance, bought four more.

Here are some of the things Dana likes about Bryant 3216's: —

"they're economical . . . we're able to have one man run two machines, and cost is cut to about 60% of single-machine operation."

"the 3216 holds size consistently and finishes better."

"holds tolerance very well . . . you can depend on it to do the job it is supposed to do."

"there is almost no maintenance . . . these machines have run trouble-free since we've had them."

"simple to operate . . . easy to adjust . . . hold close tolerances . . . meet all our requirements."

Learn how the Bryant 3216 Automatic or other Bryant machines can help *you* in your internal grinding operations. Write today for literature.

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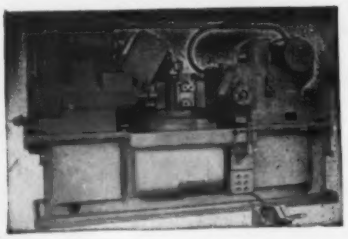
Here's what is meant by "1·2·3" in the GOSS & DE LEEUW AUTOMATIC CHUCKING MACHINE



The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a piece simultaneously or in sequence, *without changing set-up* or rehandling. It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Horton Chuck, Windsor Locks, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.

CHUCKS, Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Inc., Worcester, Mass.

CHUCKS, Power Operated

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety

Jacobs Mfg. Co., West Hartford 10, Conn.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

(*Continued on page 256*)

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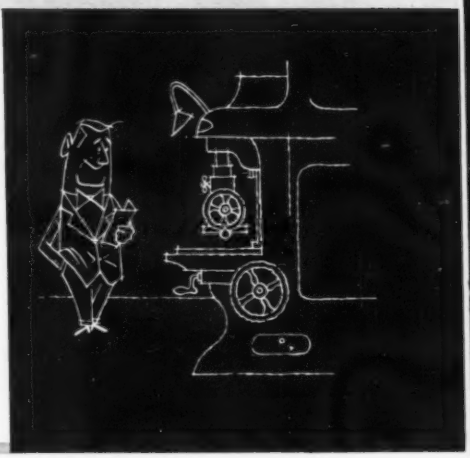

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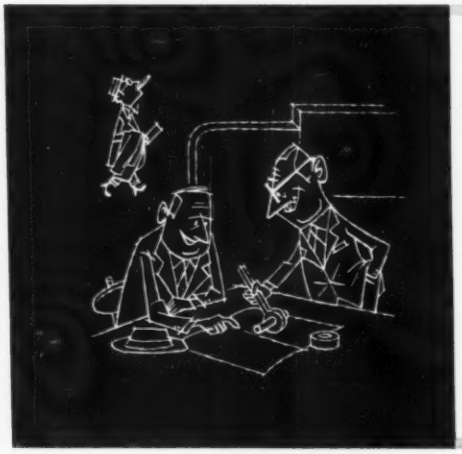

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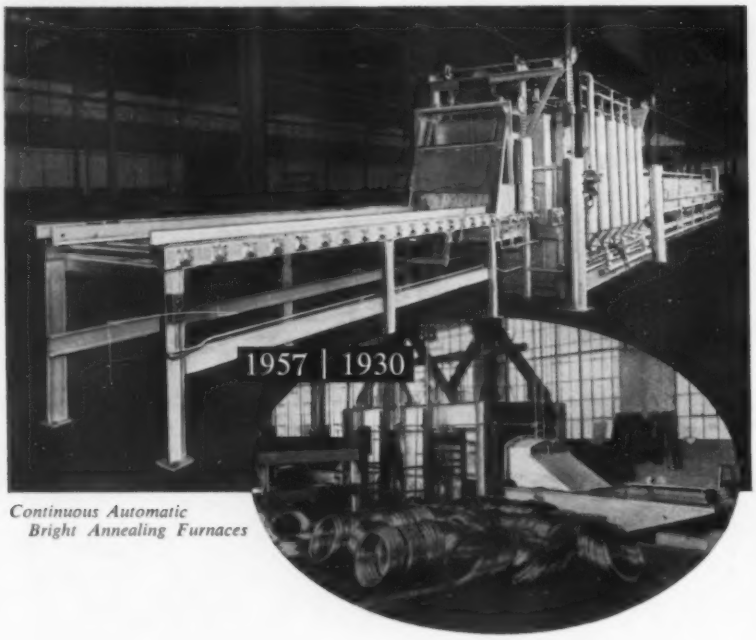

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Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
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CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

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Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Fawick Corp., Cleveland, Ohio.
Minster Mch. Co., Minster, Ohio.
Rockford Clutch Div., Rockford, Ill.

COLLETS—See Chucks, Collet

COLLOIDAL GRAPHITE
Acheson Colloids Co., 2150 Washington Ave., Port Huron, Mich.

COMBINATION SQUARES—See Machinists' Small Tools

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DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Sheffield Corp., Box 893, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

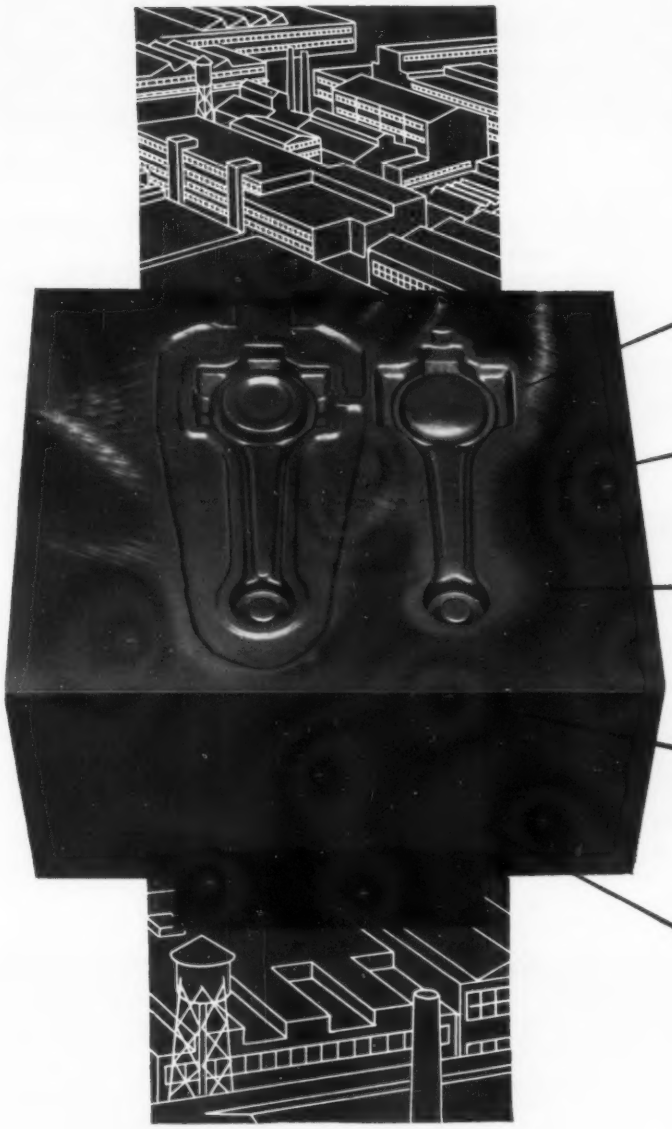
COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., 54 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 1, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

...somewhere this forging die is making history!



Both halves of the die were Eloxed in only 50 hours.

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After washout, Elox equipment will have it back in service in seven hours.

In our Pre-purchase Evaluation division we will demonstrate how Elox can machine the cavities in your closed impression dies at 75% of your present cost. Write or phone today.

10″ Connecting Rod Forging
Max. depth impression: ⅜″
Min. depth impression: 1/16″
Tolerances: + or − .003″

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ELOX keeps you ahead of competition • All forms of Die Making • Form Grinding and Tool Sharpening

1833 N. Stevenson Highway • Royal Oak 3, Michigan

For details on how EDM machining of cavity type dies can prove profitable for you, write for Bulletin P7-1257

For more information fill in page number on Inquiry Card, on page 227

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Bliss, E. C., Co., 1375 Raff Rd., S. D., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Van Keuren Co., Watertown, Mass.

CONTROLLERS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.

CONTROL SHAFTS—See Lead-screws & Splines, Ball Bearing

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes, W. F. & John Co., Rockford, Ill.
Commercial Filters Corp., Melrose, Mass.

COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES AND COUNTERSINKS
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp. 30 E. 42nd St., New York
Heller Tool Co., Newcomerstown, Ohio.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

COUNTERS
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Philadelphia Gear Works, Erie Ave., and G Sts., Philadelphia, Pa.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa. (Shaft)
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTERS, Keyseating
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (End mills)
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Garton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Haynes Stellite Co., Kokomo, Ind.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., Niles, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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The completely new GREAVES No. 2-XH Milling Machine brings added versatility, increased operational ease, and more power where it's needed most . . . *at the cutter!*
It utilizes two motors, one for spindle drive; a separate motor for moving table, saddle and knee. Compare this and the other outstanding features of the new Greaves Mill. You'll see why Greaves is "The MOST Mill for the LEAST Money."

- Wide range of speed/feed combinations for any type material, any type job.
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- Easy-to-reach controls. Handwheels and vertical crank disengage automatically when not in use.
- New rapid traverse lever within operating control area.
- Separate drive motor for table, saddle and knee provides more smooth balanced power at the cutter.

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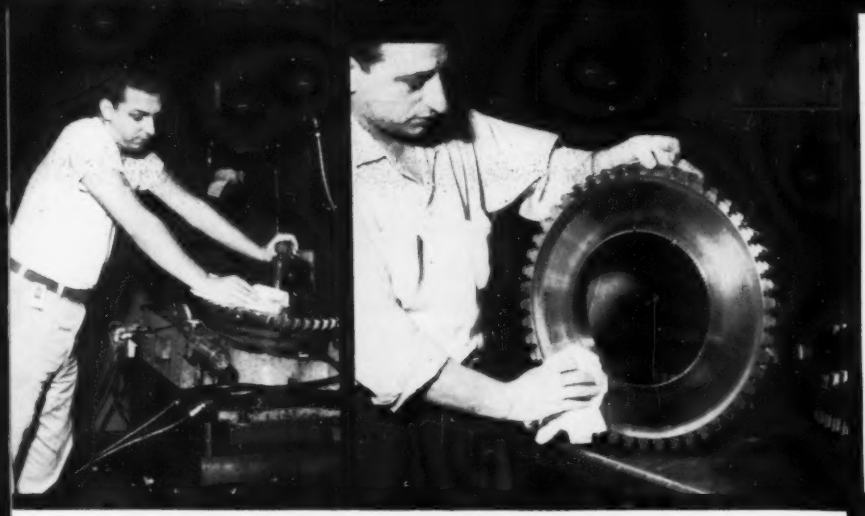

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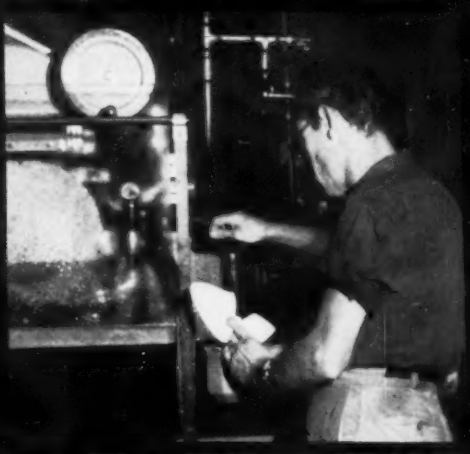
many
reasons:



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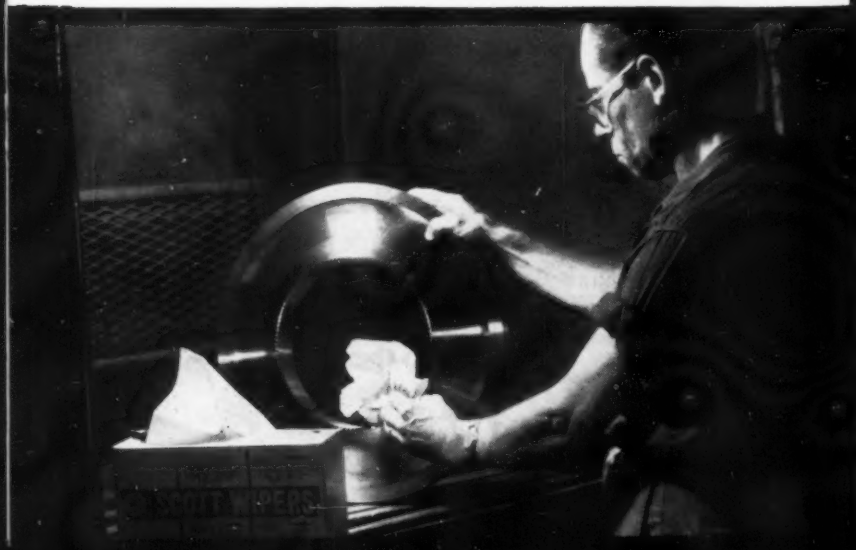

Curtiss-Wright uses Scott Wipers for wiping parts before broaching, broaching machines themselves, grinding machines, and at inspection stations. They are soft, yet tough—and their wet strength makes them ideal for wiping up oils and coolants.

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Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

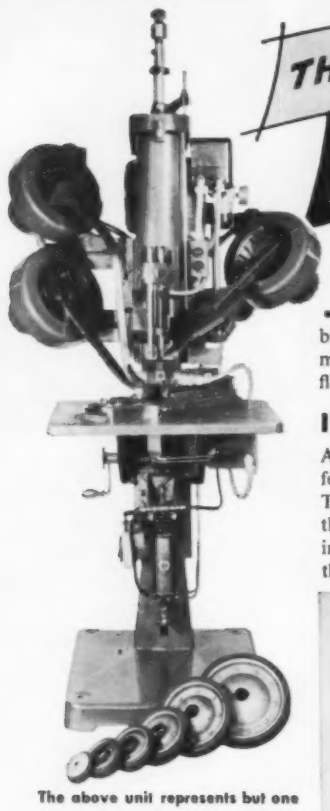
CUTTING-OFF MACHINES, Lathe Type

Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material



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A screw, lock washer and nut are automatically fed and oriented, each from a separate parts feeder. The operator simply places the wheel segments in the locating fixture, starts the machine cycle indexing to the proper driving point, at which location the assembly is completed.

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Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Thompson Products, Inc., Warren, Mich.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee Wis.
Thompson Products, Inc., Warren, Mich.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Lufkin Rule Co., Saginaw, Mich.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dayton Rogers Mfg. Co., Minneapolis, Minn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

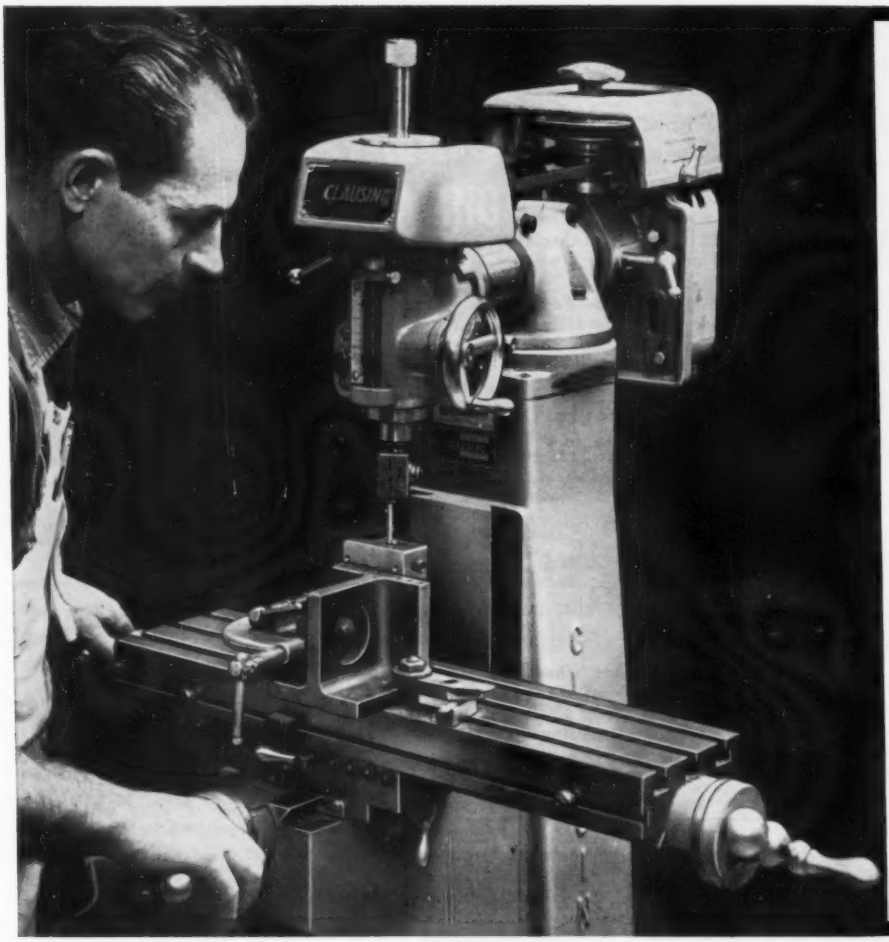
DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

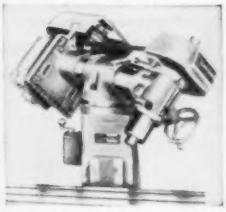
DIE SETS AND DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wales-Strippit Co., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.



The high precision spindle and drive have 7 ball bearings . . . hardened spindle. Ground and hard chrome plated quill has full length bearing in head.



The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to machine at all angles with one set-up.

HERE'S PROOF OF PERFORMANCE . . .

"The Clausing Vertical Miller is the best machine for the money on the market today! It is most versatile . . . and extremely accurate". — F. L. BALLENTINE, EMPIRE TOOL ENGINEERING COMPANY, INC.

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2. T-slots square with cross slide dovetails within .0005".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

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DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.

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Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing

Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading

Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling

Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

DISINTEGRATORS

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Electro-Spark Co., Inc., 23 E. 26th St., New York 10, N. Y.
Elox Corp., Royal Oak 3, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
DoAll Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAWING COMPOUNDS

Oakite Products, Inc., 26 Rector St., New York 6
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

DRESSERS, Grinding Wheel

Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

DRIFT KEYS

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Snow Manufacturing Co., Bellwood, Illinois

DRILL SLEEVES AND EXTENSION HOLDERS

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Richmond, Ind.
National Twist & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.

DRILLING AND BORING UNITS, Self-contained

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.

(Continued on page 264)

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Restriction of heat to end of holder body for fuel injector permits hardening of face to provide required resistance to deformation without hardening the threads. Coil design shown provides uniform temperature for hardening despite holes in face.

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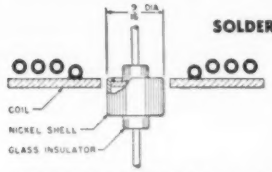

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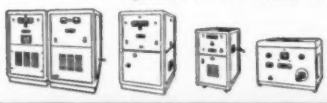

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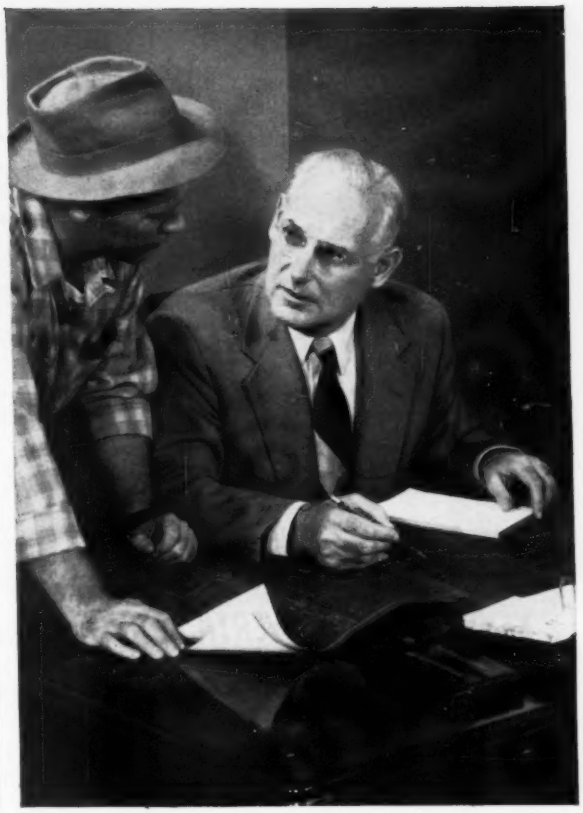

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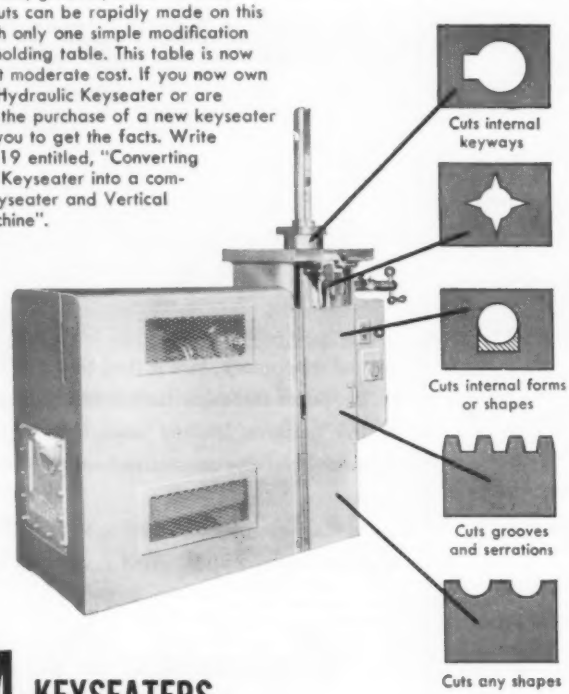

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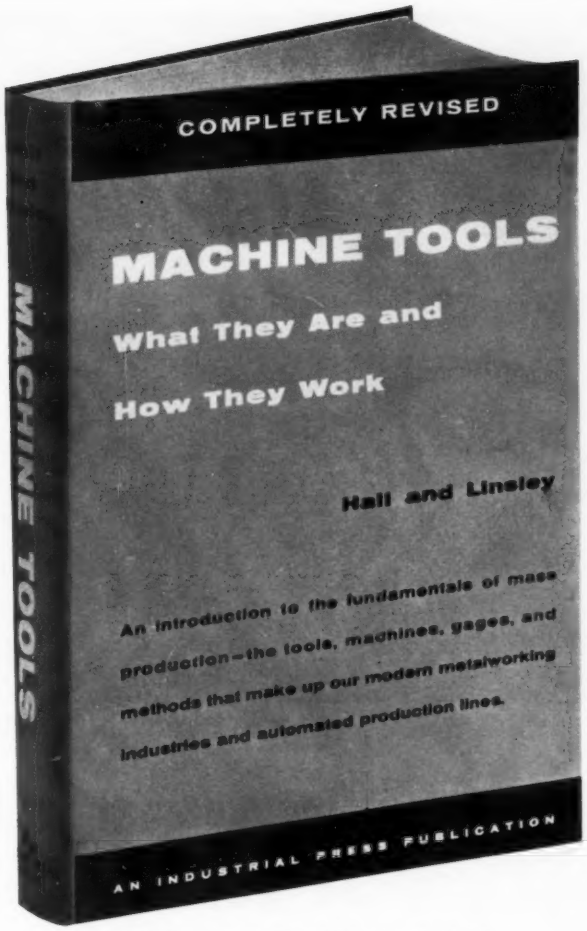
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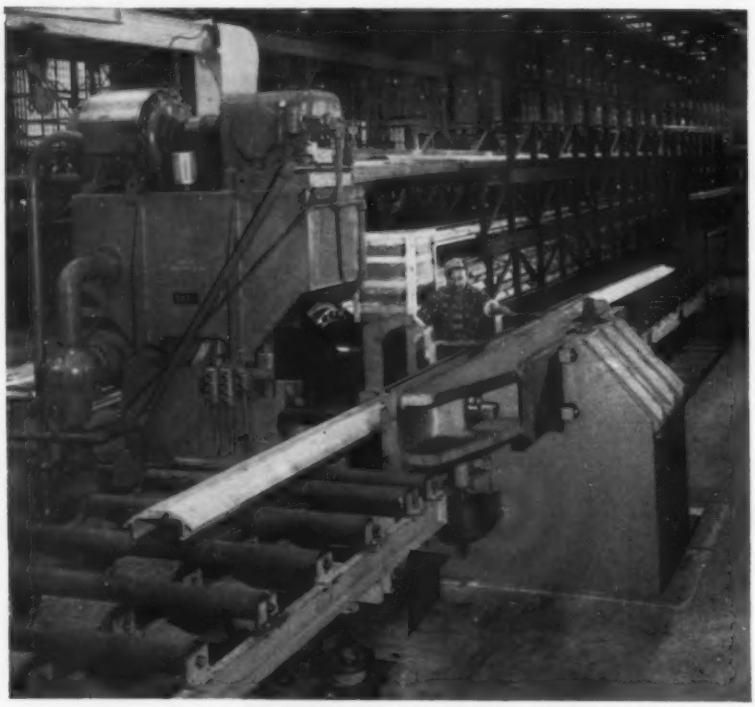

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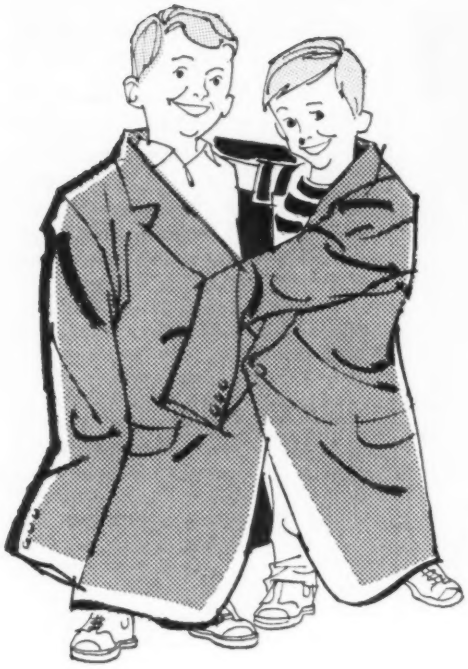

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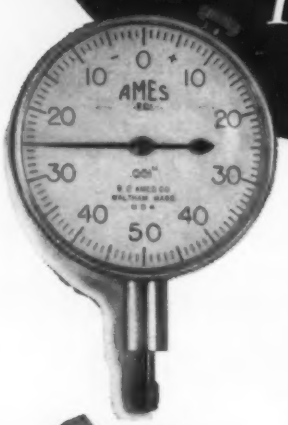

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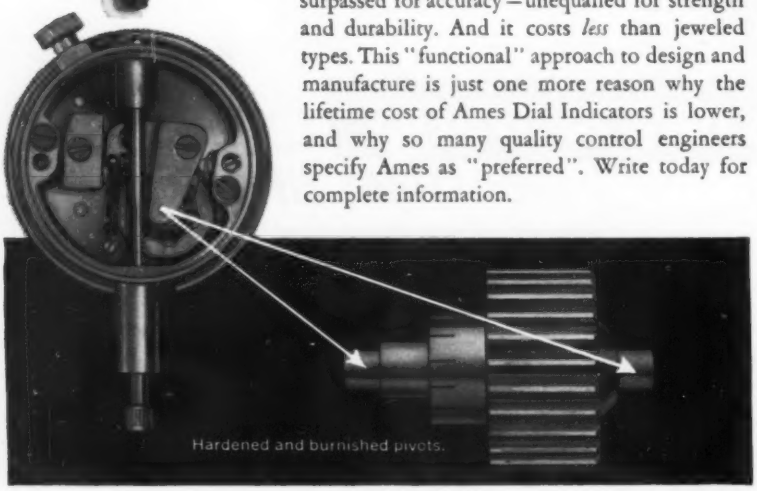

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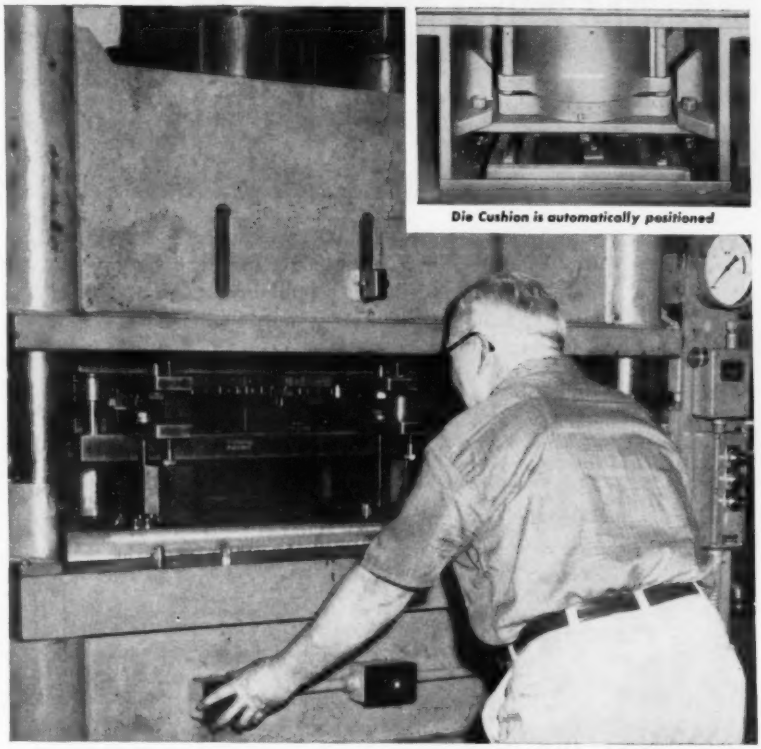
Wagner Brothers, Inc., 433 Midland Ave., Detroit 3, Mich.

"TWO PRESSES IN ONE"

REPORTS STEWART-WARNER CORP., CHICAGO, ILL.



Die Cushion is automatically positioned

K. R. WILSON FOUR-COLUMN PRESS

Model No. 100SE-4840

"GIVES US PRECISION ACCURACY FOR DIE-TRYOUT . . . SPEED AND VERSATILITY FOR SHORT PRODUCTION RUNS."

The new K. R. Wilson Four-Column, Down Acting Press recently delivered to Stewart-Warner Corp. does "double duty" in their Chicago plant. The 100 ton capacity press features an automatically-positioned pneumatic die cushion. With the cushion in position, the press can be used both for die-tryout and for production runs utilizing forming or drawing dies. When the cushion is retracted, spring loaded dies can be used. With the air evacuated from the cushion, the press can be used for blanking. With such operational flexibility, and rapid conversion features, the K. R. Wilson Model No. 100SE-4840 Press can be kept in nearly continuous operation. Get all the facts now on this time-saving, money-making press.

SPECIFICATIONS:

DIE CUSHION Capacity—tons	22.6
DAYLIGHT — in/max.	24
RAM STROKE — in	18
RAM SPEEDS — in/min.:	
Approach	160
Pressing	29
Return	250
CONTROLS — Electric Push Button	
20 H.P. UNIT	

HYDRAULICS DIVISION

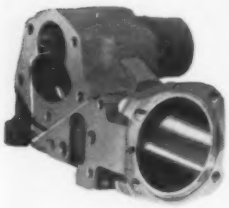
K. R. WILSON, Inc.

OFFICES & FACTORIES — 212 MAIN ST., ARCADE, N. Y., U. S. A.

Why MICROHONING

Is Final Stock Removal Process For Interrupted and Blind-End Bores

To secure low-cost, final stock removal, that generates accuracy and functional surface characteristics in a variety of bore conditions, a leading manufacturer of power steering assemblies uses Microhoning. Here are details concerning types of bores and stock removal results obtained by using Micromatic "Know How"—



STEERING GEAR HOUSING—Microhoning consistently corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—cuts boring tool sharpenings—lowers down-time and tool costs.

Material: Soft Malleable Iron
Bore: 3.125"D x 6.93"L (Ported bore with ¼" relief at blind end)
Stock Removal: .002"
Finish: 50 Microinches RMS
Microhoning Cycle: 18 sec.
Preceding Operation: Boring

PISTON RACK—Microhoning answers the need for a final stock removal process that generates a controlled surface finish in the bore of this leaded steel part. Microhoned surface (cross hatch) prevents oil leakage and holds to a minimum the wear of seal that operates in the bore.

Material: Leaded Steel (Rockwell 62 "C")
Bore: .875"D x 3"L
Stock Removal: .005"
Finish: 20 Microinches RMS
Microhoning Cycle: 20 sec.
Preceding Operation: Boring and H.T.

VALVE HOUSING—Microhoning consistently holds size and geometric accuracy—meets stringent surface requirements—assures alignment of four lands in bore. Thus, there is no leakage of oil around control valve which is selectively fitted to its housing.

Material: Cast Iron
Bore: .770"D x 2.18"L (Interrupted)
Stock Removal: .0025"
Tolerances: Size .0005"
Roundness .0001"
Straightness .0001"
Finish: 10 Microinches RMS
Microhoning Cycle: 12 sec.
Preceding Operation: Boring

The principles and application of Microhoning are explained in a 30-minute, 16mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____ G
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

EXPANDERS, Mechanical, Hydraulic
Grotnes Machine Wks., Inc., 5454 N. Walcott, Chicago 40, Illinois

EXTRACTORS, Screw
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Walton Co., Hartford 10, Conn.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div. Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FEEDERS, Automatic
Perry Equipment & Eng. Co., Erie, Penna.
Production Feeder Corp., Mentor, Ohio
V & O Press Co., Hudson, New York

FILES, Band
DoAll Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoAll Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoAll Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Severance Tool Ind., Inc., Saginaw, Mich.
Simonds Saw & Steel Co., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Melrose, Mass.
Industrial Filtration Co., 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FINISHES, Machine and Metal
Lowe Bros. Co., Dayton, Ohio

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 100 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.

FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Machinery Co., Tiffin, Ohio

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.
Wyman-Gordon Co., Worcester, Mass.

FORGING, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
U. S. Steel Corp., Pittsburgh, Pa.

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
New Departure Div., Bristol, Conn.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

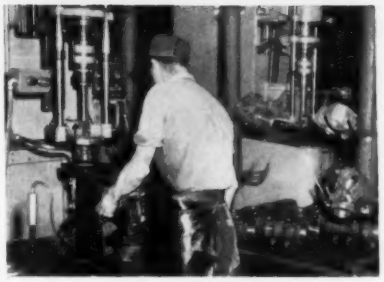
FORMING MACHINES, Cold-rolling
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

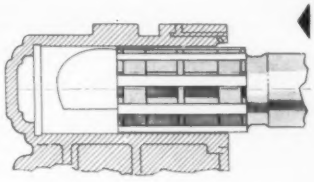
FORMING MACHINES, Multiple-slide
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North Main St., Ampere, N. J.

How MICROHONING

Cuts Costs—Generates Accuracy—Speeds Production of Interrupted, Blind-End Bores

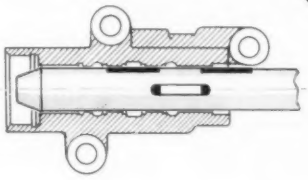
Shown are two Microhoning machines that are used in the plant of a leading manufacturer of automotive power steering assemblies. Machines are equipped with automatic stone feed and stonewear compensating mechanisms, and automatic sizing controls. A two-position rotary fixture is interlocked with machine controls for fully automatic index cycle. The following applications tell more of the "how".





STEERING GEAR HOUSING—In Microhoning the ported, blind-end bore of steering gear housing a nine-stone tool is used. At least six of nine stones are in contact with bore surface when tool passes over irregularly shaped port. Removing .002" of stock from 3.125"D x 6.93"L bore in 18 seconds, Microhoning generates final accuracies and a controlled finish of 50 microinches as specified.

PISTON RACK—In 20 seconds, Microhoning removes .005" of stock from .875"D x 3"L open end leaded steel bore of piston rack. Self-sharpening abrasives assure a consistent generation of specified surface finish of 20 microinches.



VALVE HOUSING—Microhoning tool used for final stock removal in bore of valve housing has one bank of stones and two banks of plastic guides—three stones or guides in each bank. Guides act as tool pilots and stabilizers in interrupted bore—prevent overcutting at edges of lands—assure straight bore by keeping tool aligned. Self-dressing abrasives consistently generate geometric accuracy of .0001" and surface finish of 10 microinches.

Microhoning economically removes stock—corrects cumulative inaccuracies of preceding operations—reduces scrap—permits faster boring—lowers machine tool downtime and maintenance to cut costs and speed production.

Send Coupon for Complete Information

Learn how Microhoning will give efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME _____ G
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

NOW—put this BRAND NEW MAGNETIC CHUCK to work for you!

PRECISION FINE-GRID DESIGN

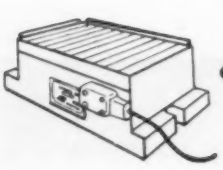
Poles 37% closer together

Greater holding power for small as well as large pieces.

Hard Epoxy resin separators or Magna-Lock special soft metal. Epoxy resin separators are easy to grind in and are particularly suited to electrolytic grinding operations because they resist electrolytic action. Magna-Lock special soft metal is preferred by some and is available as an alternate material for all Magna-Lock fine grid chucks.

Available in all sizes.

It will pay you to get all the facts about this powerful new Magna-Lock magnetic chuck *now*. Write Dept. M-18.



Hanchett **MAGNA-LOCK**
CORPORATION
BIG RAPIDS, MICHIGAN, U. S. A.
Designers and makers of a complete line of magnetic chucks and devices.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Automatic Sorting
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.
Ames. B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Starrett, The L. S., Co., Athol, Mass.

GAGES Electric Comparator
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Grinding
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

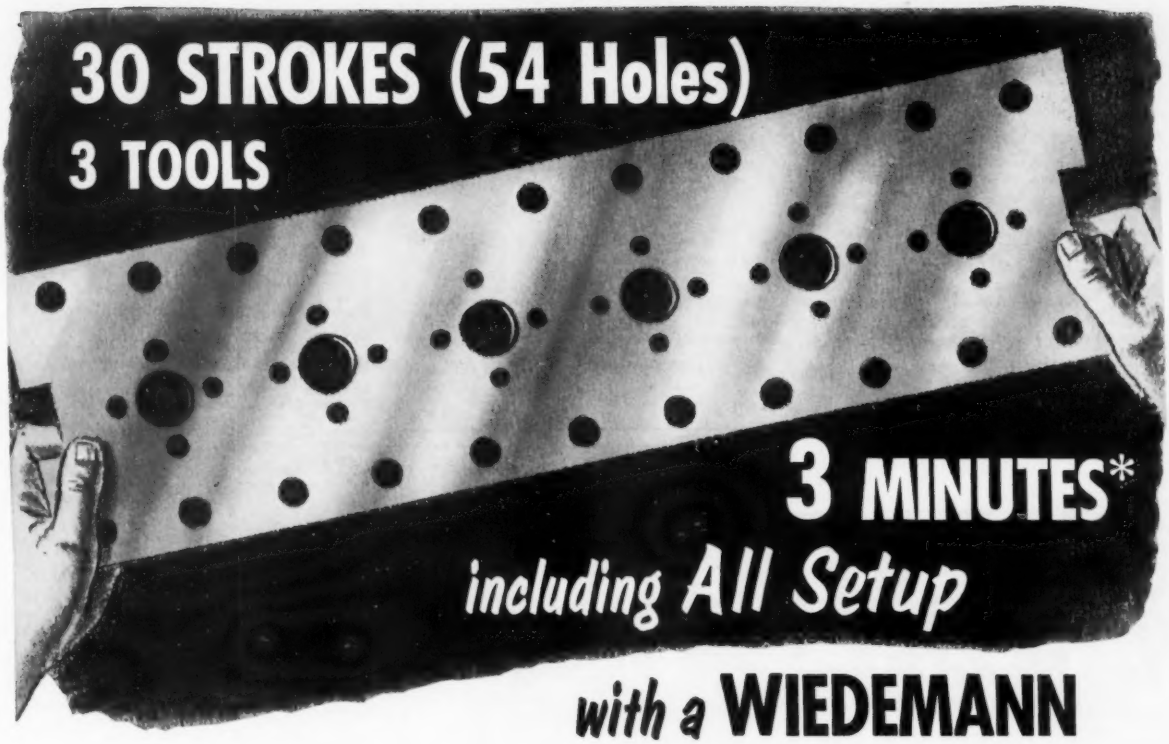
GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper, Telescoping Thickness
Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., Des Plaines, Ill.

(Continued on page 276)

30 STROKES (54 Holes)
3 TOOLS



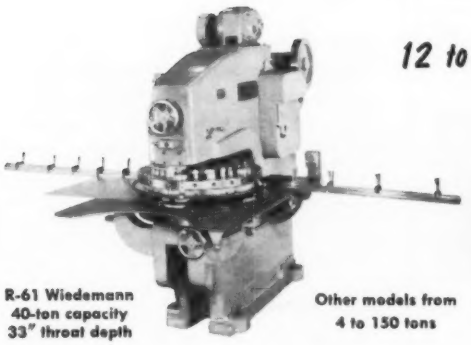
3 MINUTES*
including All Setup
with a WIEDEMANN

How long would it take you to produce this job from scratch? . . . 30 minutes? . . . 2 hours? . . . 4 hours?

Using a Wiedemann Turret Punch Press, this job was completed in 185 SECONDS (additional parts only 65 seconds each). Here is production speed that is almost beyond belief—unless you have seen a Wiedemann in action or have had a time study made of your work.

The unmatched speed and flexibility of a Wiedemann Turret Punch Press can cut your short to medium run piercing costs 60% to 90%. To get the facts, send drawings of your work for time study, or write for Bulletin 301 today.

* *Pierced on an R-61 Wiedemann with drop latch gauge (illustrated). Time includes rotating turrets to required punch and die stations, and setting the quick-acting gauge—simple mechanical functions which eliminate all tool setup and layout.*



R-61 Wiedemann 40-ton capacity 33" throat depth

Other models from 4 to 150 tons

12 to 32 Punches and Dies Ready for Use

WIEDEMANN MACHINE COMPANY
TURRET PUNCH PRESSES

4205 WISSAHICKON AVE., PHILADELPHIA 32, PA.

Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Pressure, Air and Hydraulic

Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett Co., L. S., Athol, Mass.

GASKETS

Garlock Packing Co., Palmyra, N. Y.

GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Layfayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel and Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

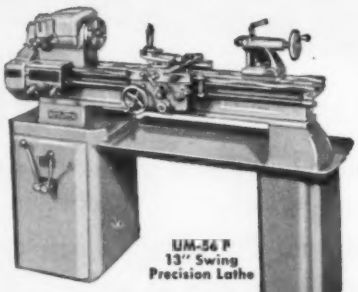
SHELDON Precision LATHES

for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13"... in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

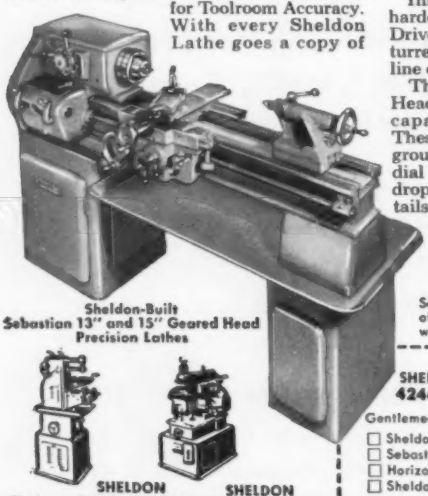
All Sheldon Lathes have handscraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of the accuracy tests actually performed on that lathe. (19 checks).



UM-54 P 13" Swing Precision Lathe

Important optional features include: hardened bed ways, L00 Long Taper Key Drive spindles, 4" D1 Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



Sheldon-Built Sebastian 13" and 15" Geared Head Precision Lathes

SHELDON Horizontal Milling Machine

SHELDON 12" Shaper

SHELDON MACHINE CO., Inc.

Builders of Sheldon Lathes, Milling Machines, Shapers and Sebastian Lathes.

4246 North Knox Ave • Chicago 41, Ill.

Send in coupon or write for catalogs and names of nearest Sheldon and Sebastian Distributors where you can see these new lathes in operation.

SHELDON MACHINE CO., INC.
4246 North Knox Avenue, Chicago 41, Illinois

Gentlemen: Please send new catalogs describing:

☐ Sheldon ☐ 10", ☐ 11" ☐ 13" Lathes
☐ Sebastian 13" and 15" Geared Head Lathes
☐ Horizontal Milling Machine ☐ Name of Local Dealer
☐ Sheldon 12" Shaper ☐ Have representative Call

Name ..... Title .....

Company Name .....

Street Address ..... ☐ Company ☐ Home

City ..... State .....

GEAR LAPPERS
Fellows Gear Shaper Co., Springfield, Vt.
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New Jersey Gear & Mfg. Co., Hillside, N. J.
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Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
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GEARS, Cut
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Horsburg & Scott Co., 5114 Hamilton, Cleveland, Ohio
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Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
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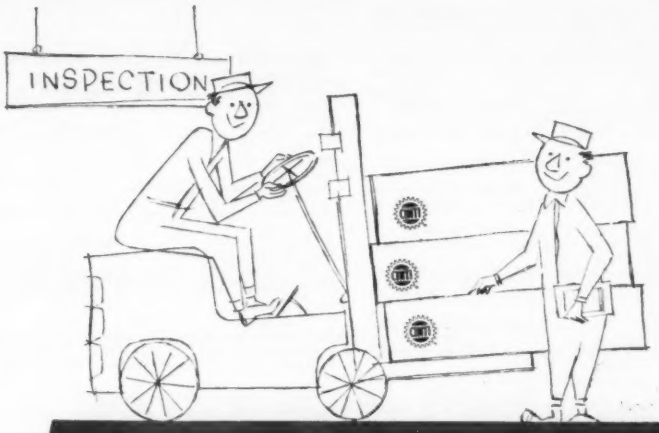
(Continued on page 282)



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Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
National Automatic Tool Co., S. 7th-N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The, L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INSPECTION EQUIPMENT, Ultrasonic

Curtiss-Wright Corp., Caldwell, N. J.

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Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.

JACKS, Planer—See Set-up Equipment

JIG BORERS

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American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cleereman Machine Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., 450 Fair Ave., Ferndale, Detroit 20, Mich.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
M. B. I. Export & Import, Ltd., 475 Grand Concourse, New York 51, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Northwestern Tool & Eng. Co., 117 Hollier Ave., Dayton 3, Ohio

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Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
La Salle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Metal Carbides Corp., Youngstown 12, Ohio
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Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

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Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.
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Reed Rolled Thread Die Co., P. O. Box 350 Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio

(*Continued on page 284*)

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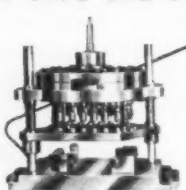
FIXED CENTER DRILLING HEADS with JIGS and FIXTURES

Do more . . . and do it better with Errington Fixed Center Drilling Heads. They drill any number of varied size holes on different elevations. The head has grooved thrust ball bearings at all thrust points and hardened bronze radial bearings. Heat treated spindles and gears of one piece turned from solid bar stock. It is geared approximately 2:1. All enclosed in a sand-cast aluminum case and cover, with alemite pressure lubrication.



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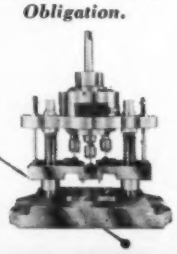

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ERRINGTON Mechanical Laboratory, Inc.

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Main Office and Plant: STATEN ISLAND 4, NEW YORK

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DENISON Multipress increases pen production 800% at **WATERMAN PEN**

This hydraulic Multipress is blanking and forming Waterman C/C pen points at a rate of 4800 per hour. Operating a five stage die, the Multipress with its fast, uniform hydraulic ram action assures continuous production with absolute protection to the intricate die itself. Considerable savings in both material and operating press time are also realized by the added advantage of hydraulic ram control where ram pressure can be set to close limits.

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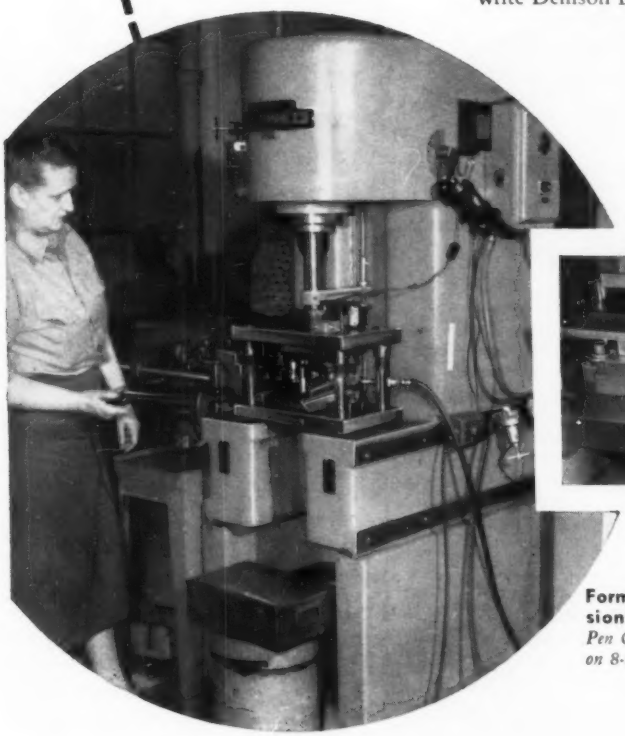

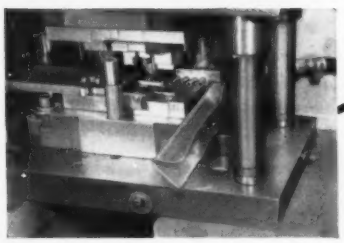

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DENISON HydrOILics

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Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

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Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
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Seneca Falls Mch. Co., Seneca Falls, N. Y.
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Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Car Wheel

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating—See Lathes, Duplicating

LATHES, Crankshaft

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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
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Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Pilot Div., Cone Automatic Mch. Co., 30 Rockefeller Plaza, New York, N. Y.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.
Sidney Machine Tool Co., Sidney, Ohio

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Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Eustacchio, S., Brescia, Italy
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

(Continued on page 286)

Caterpillar REG. U.S. PAT. OFF. Tractor Co. gets results . . . with Talide S-92

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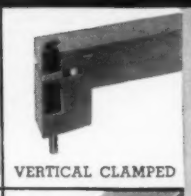
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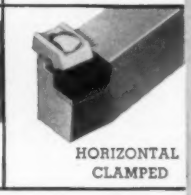
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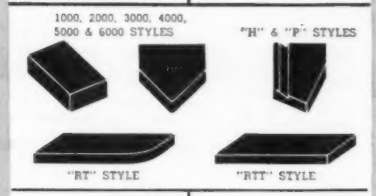

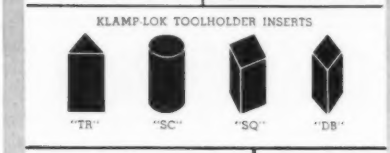

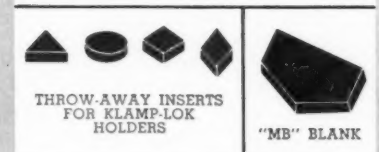

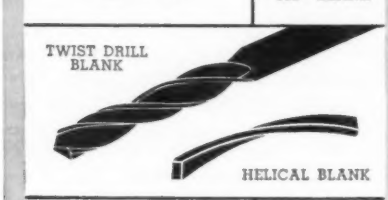

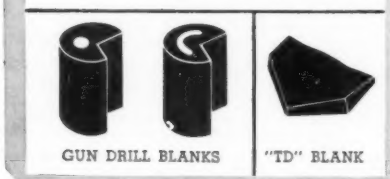

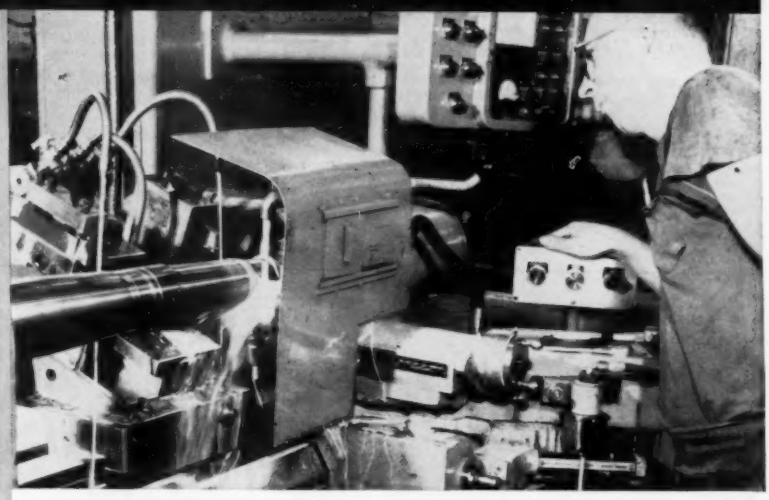

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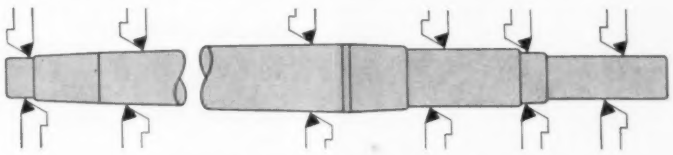

CRAWLER TRACTOR AXLE SHAFT

Part . . . . . Crawler Tractor Axle Shaft

Material . . . . . SAE 8645 Steel Forging 3¼" dia. x 38½" long, 3.6mm Brinell Hardness.

Operation . . . . Rough turn all diameters, form tapers, shoulders, and steps.

Machine . . . . . Monarch Mona-Matic No. 21 Tracer Lather, size 54".

Tools . . . . . 12 Talide TB-164 ½" I.C. Triangular TALIDE Throw-Away Inserts mounted in Klamp-Lok Toolholders, Grade S-92.

Depth of Cut . . ⅜"

Feed . . . . . 6" per min.—.018 F.P.R.

Speed . . . . . S.F.M. 387—R.P.M. 340

Coolant . . . . . Soluble Oil and Water

Results . . . . . TALIDE Grade S-92 turned 7 shafts per corner per grind for total of 42 shafts per grind. Inserts were ground an average of 6 times and produced a total of 294 shafts over life of insert. Next best premium carbide grade produced 235 shafts.

Call in a Talide sales engineer to recommend proper tooling for your machining operations, or write for 76-page catalog No. 57-G. METAL CARBIDES CORPORATION, 6001 Southern Blvd., Youngstown 12, Ohio.

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Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Engine, Toolroom

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kiskwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Western Machine Tool Works, Holland, Mich.

LATHES, Gap

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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
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Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

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Atlas Press Co., Kalamazoo, Mich.
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Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4 Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type

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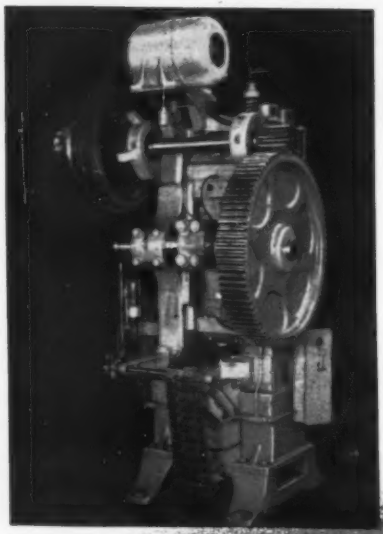
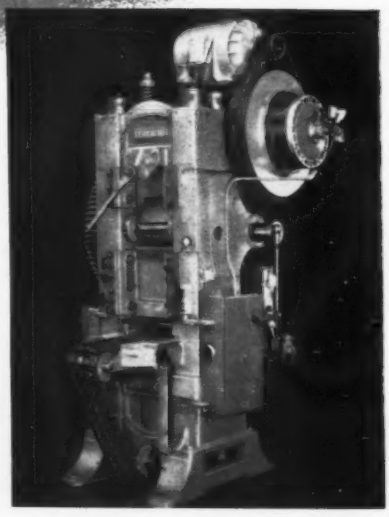
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave.,



FERRACUTE

E-401 EMBOSSING PRESS ELIMINATES EXPENSIVE MILLING OPERATIONS FOR AUTOMOTIVE MANUFACTURER

Ferracute Embossing Press E-401, 400 ton model



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New Britain Mch. Co., New Britain Gridley Div., New Britain, Conn.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

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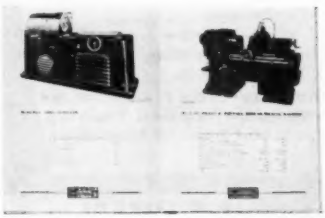

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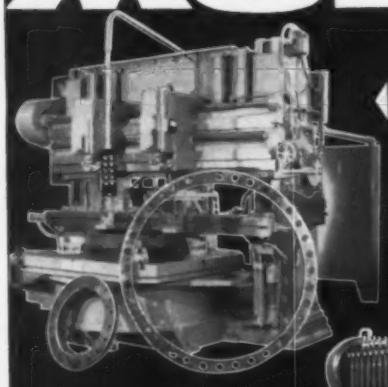
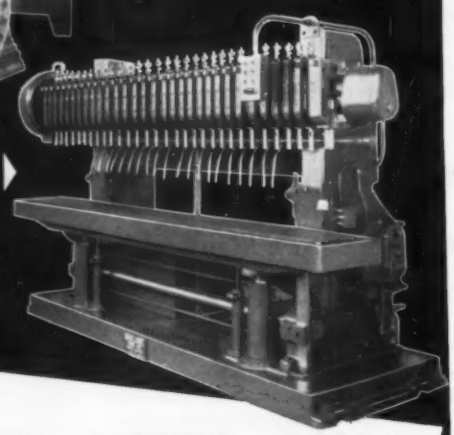


HD68 drills bolt circles from 12" to 100" diameter. Each of the two spindles has capacity for 2½" drill in steel. Operating cycle is fully automatic.



HD13 straight line-type drilling machine with capacity for thirty ¾" drills in steel. Used for work on heavy castings, round and rectangular steel tubes, structural shapes, plates and grader blade drilling or countersinking.

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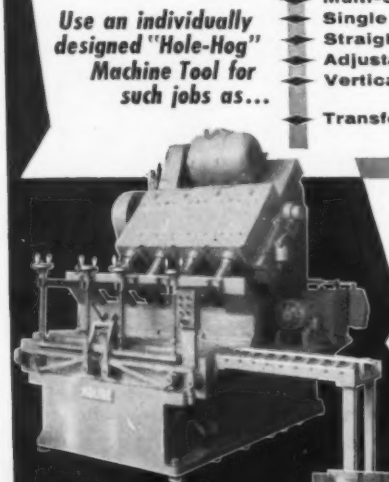

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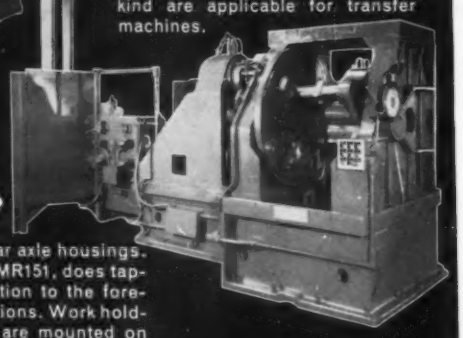
13CB hydraulic feed cylinder boring machine. V-8 engine blocks are rough and finish bored for wet-type cylinder sleeves. Units of this kind are applicable for transfer machines.



MR152 performs drilling, reaming, spot facing and chamfering operations on tractor rear axle housings. A companion machine, MR151, does tapping in addition to the foregoing operations. Work holding fixtures are mounted on power driven trunnion.

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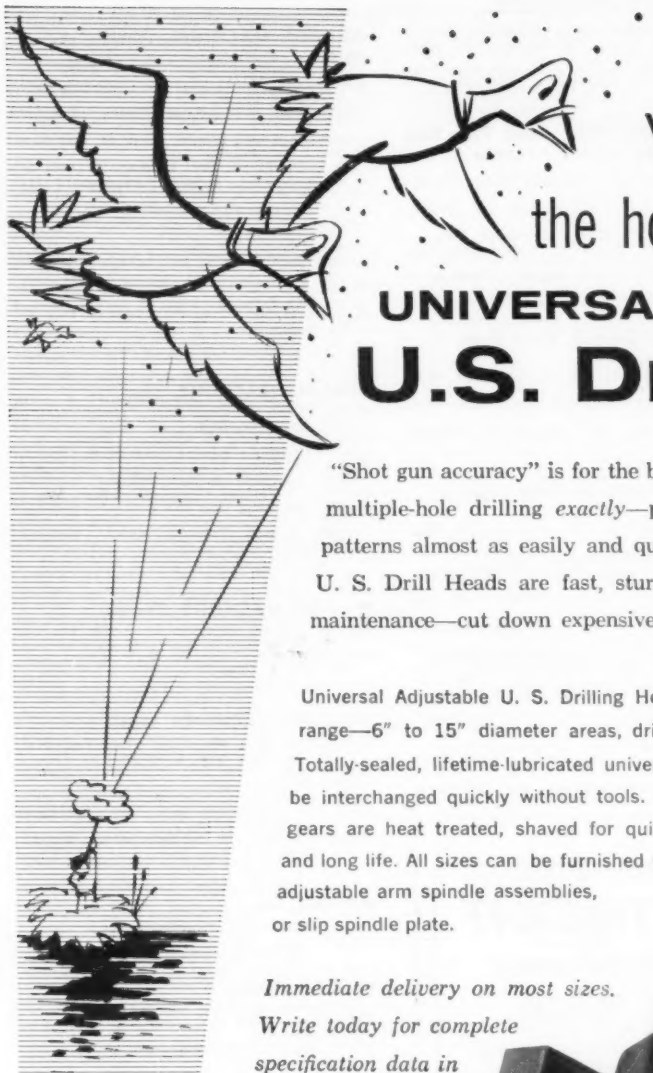
(*Continued on page 290*)



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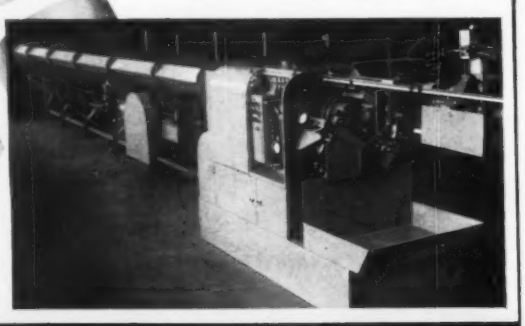

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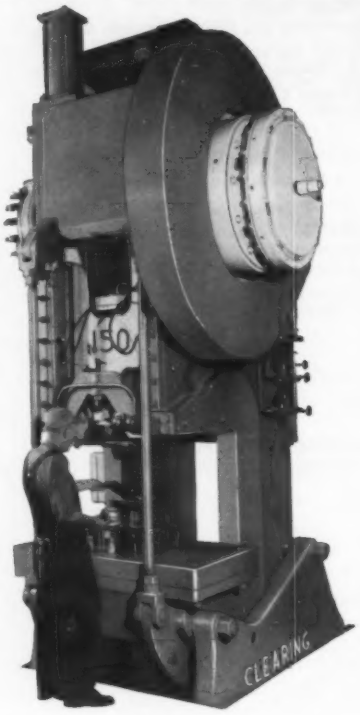

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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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Bliss Co., E. W., Canton, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Assembling

Alva Allen Industries, Clinton, Mo.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Colonial Broach & Machine Co., Box 37, Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

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Alva Allen Industries, Clinton, Mo.
Alpha Press & Machine, Inc., 9281 Freeland Ave., Detroit 28, Mich.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bath, Cyril Co., 32324 Solon Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
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Federal Machine & Welder Co., 1745 Overland Ave. N. E., Warren, Ohio
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Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 55 N. 18th St., East Orange, N. J.
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Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
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Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Enginering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
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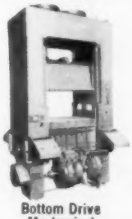
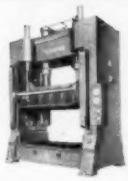

Bottom Drive Mechanical

Top Drive Mechanical

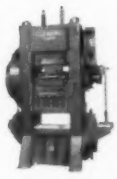
O.B.I.

Gap Frame

Trimming


Die Spotting

Transflex Modular


Knuckle Joint

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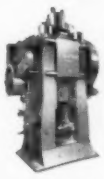
Forging

Straightening

Series-S

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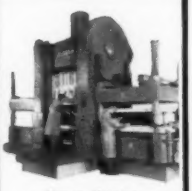
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Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Alva Allen Industries, Clinton, Mo.
Baird Machine Co., 1700 Stafford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

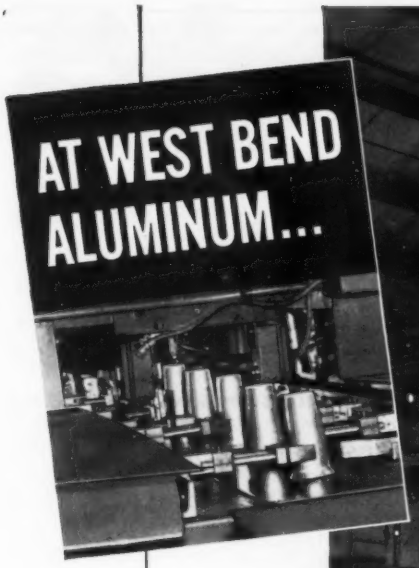
PRESSES, Foot

Famco Machine Co., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

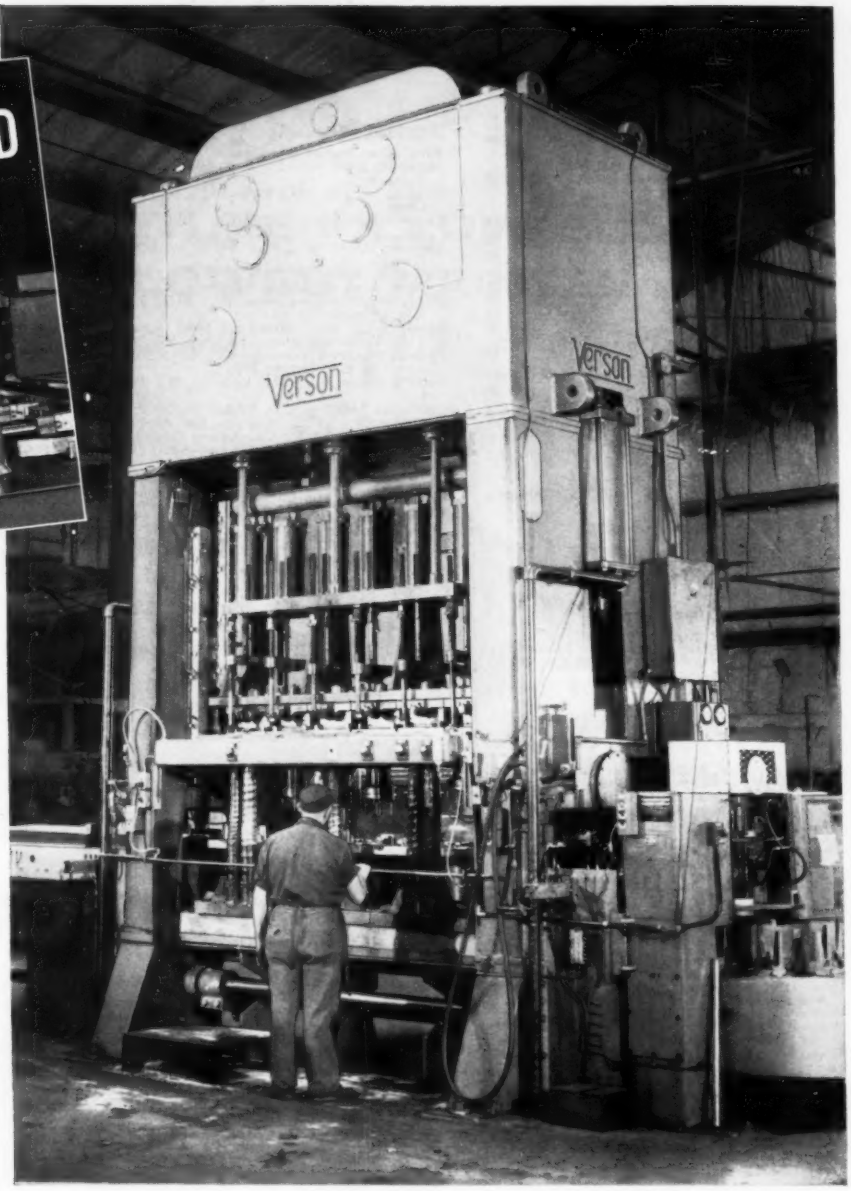
PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.

(Continued on page 296)



THIS 200 TON Verson TRANSMAT PRESS Performs 6 Operations • Produces 800 Tumblers Per Hour Automatically



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Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
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Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

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Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
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Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
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Bath Cyril Co., 32324 Aurora Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Wiedemann Machine Co., 4272 Wissahicken Ave., Philadelphia 32, Pa.
Wilson, K. R., Inc., Arcade, N. Y.

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Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

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Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming

Alva Allen Industries, Clinton, Mo.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Co., 509 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machine, Die Sinking, etc.

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic

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Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Watson-Stillman Co., 565 Blossom Rd., Rochester 10, N. Y.
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Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

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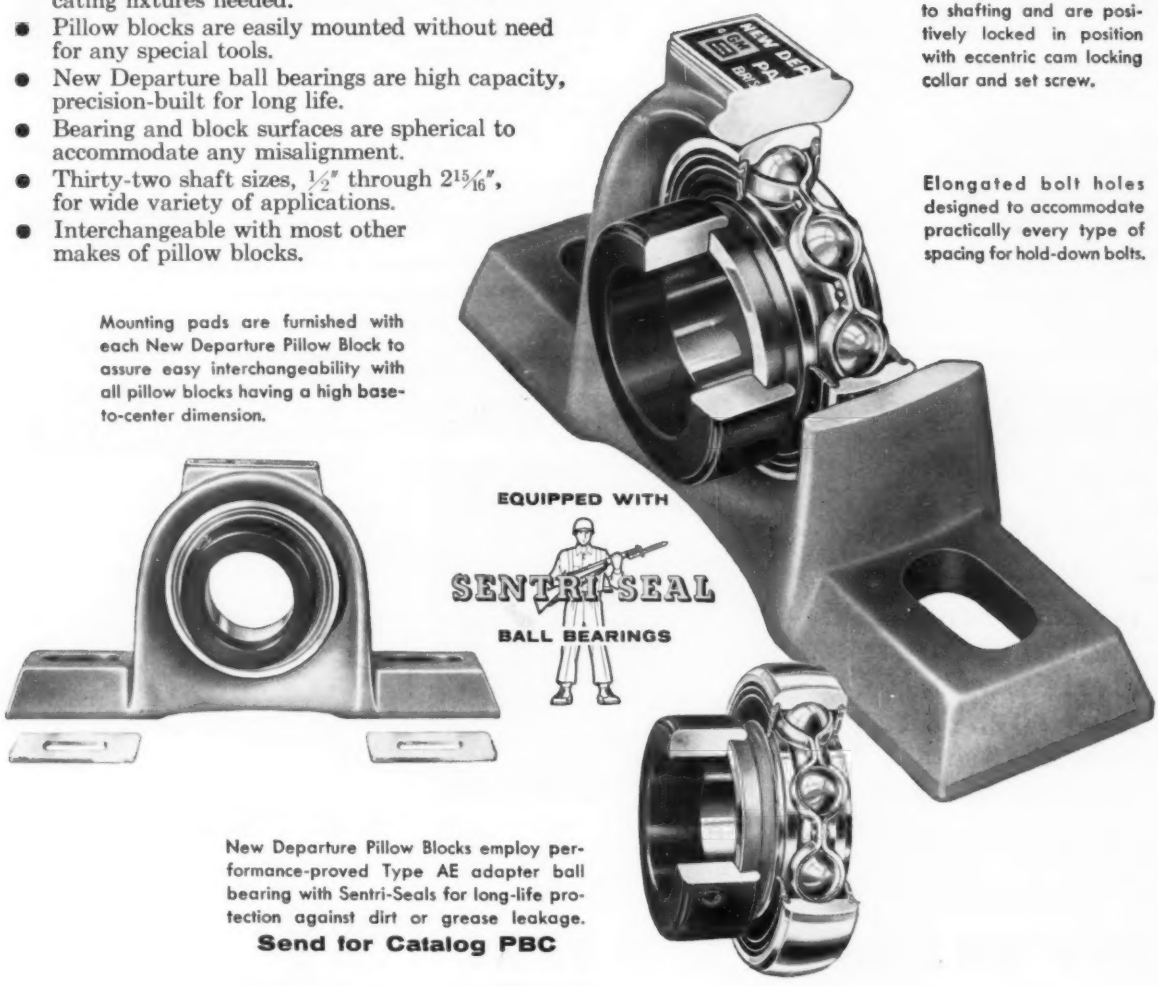

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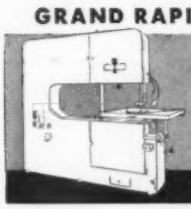

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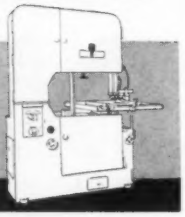

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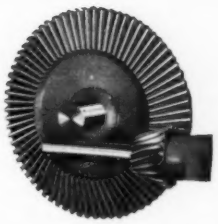

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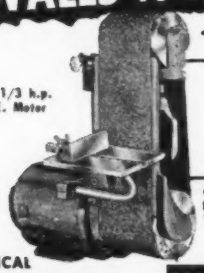

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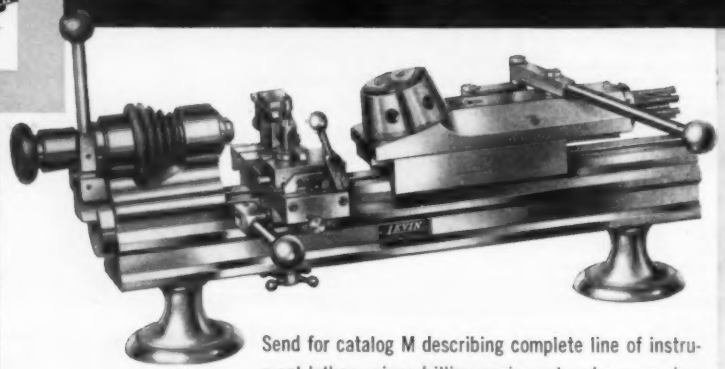

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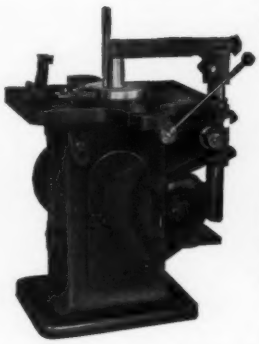

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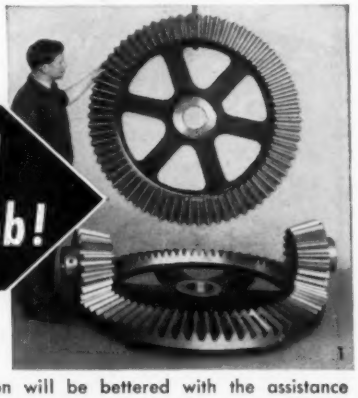

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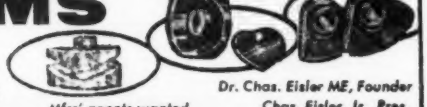

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

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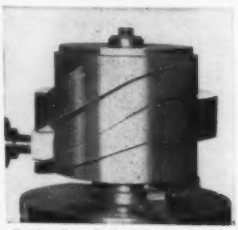
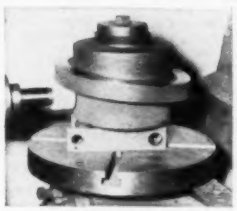
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.

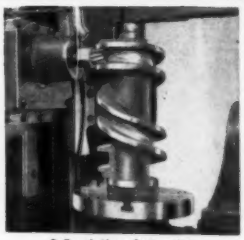


Hardened and Ground Index Cam

Press Cams



"Male" Barrel Cam



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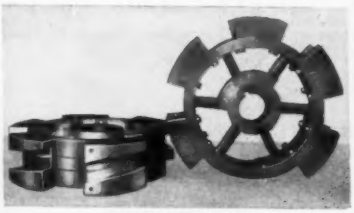
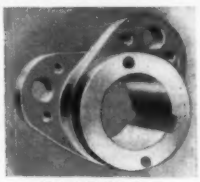


Segmental Barrel Cam

Steel Side & Barrel Cam



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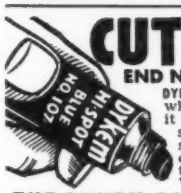

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Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

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Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
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Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
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Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Landis Mch. Co., Waynesboro, Pa.
LaSalle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
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Winter Bros. Co., Rochester, Mich.

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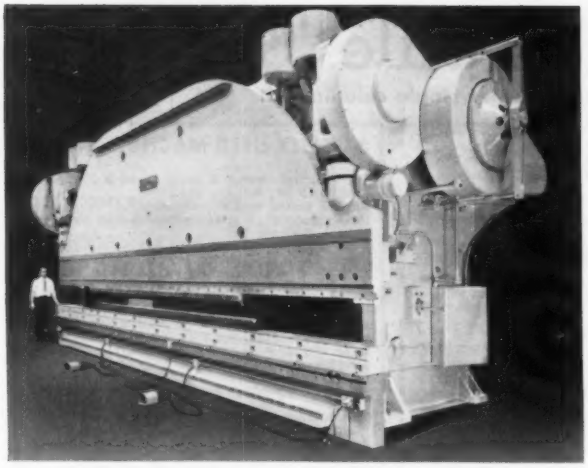

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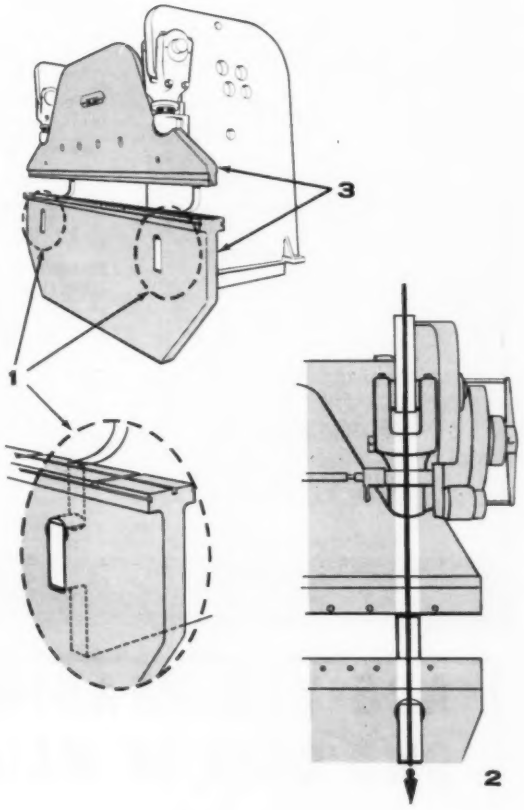

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No. 16 LeBlond Automatic, m.d.
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No. 9WSL, Reid Production
17"x75¾" LeBlond, m.d.
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No. 2K Kearney & Trecker, m.d.
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No. 5 Cincinnati H.P., m.d., late
No. 2LP Van Norman, m.d.
No. 12 Van Norman Ram Type, m.d., with 2 A.C. motors
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Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
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Kennemetal Inc., Latrobe, Penna.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metal Carbides Corp., 6001 Southern Blvd., Youngtsown 12, Ohio
R & L Tools, 1825 Bristol St., Philadelphia 40, Pa.
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Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
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Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
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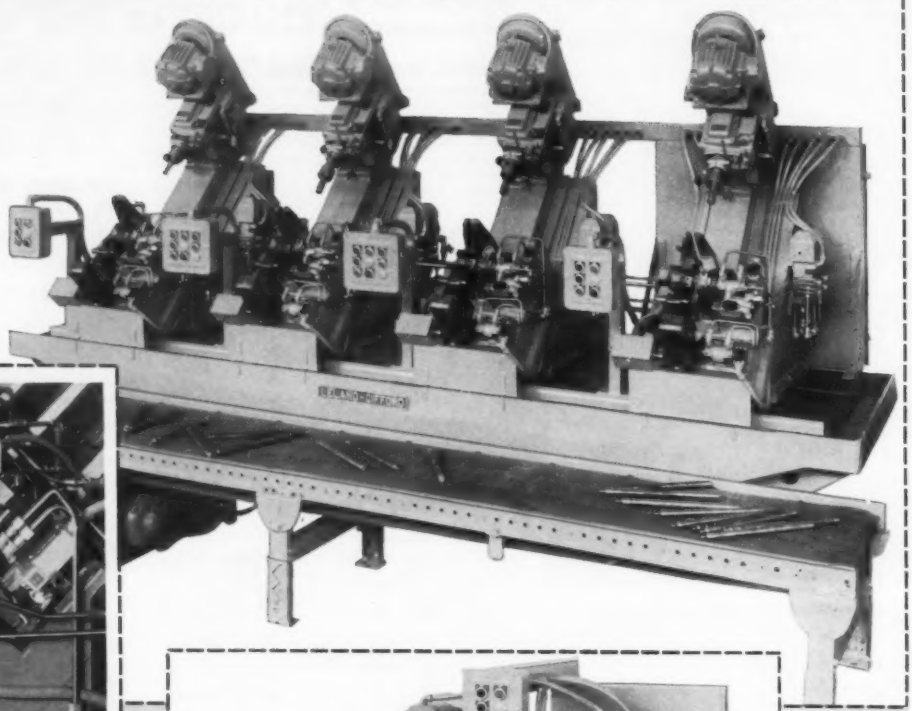

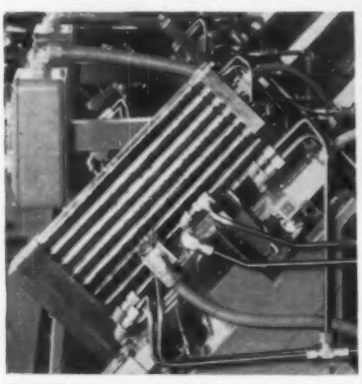

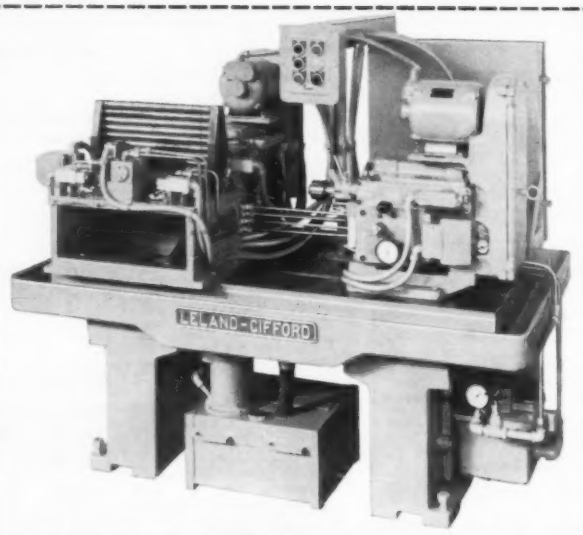

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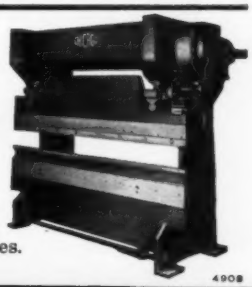

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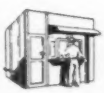
Whatever Pangborn Blast Cleaning  Machine

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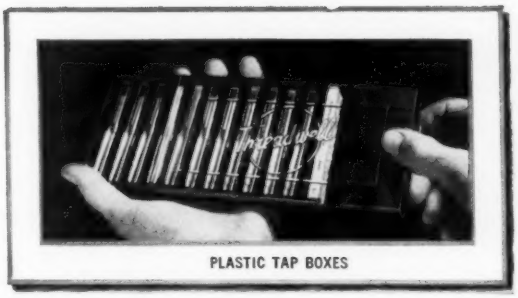

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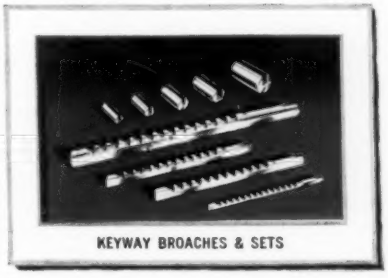

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